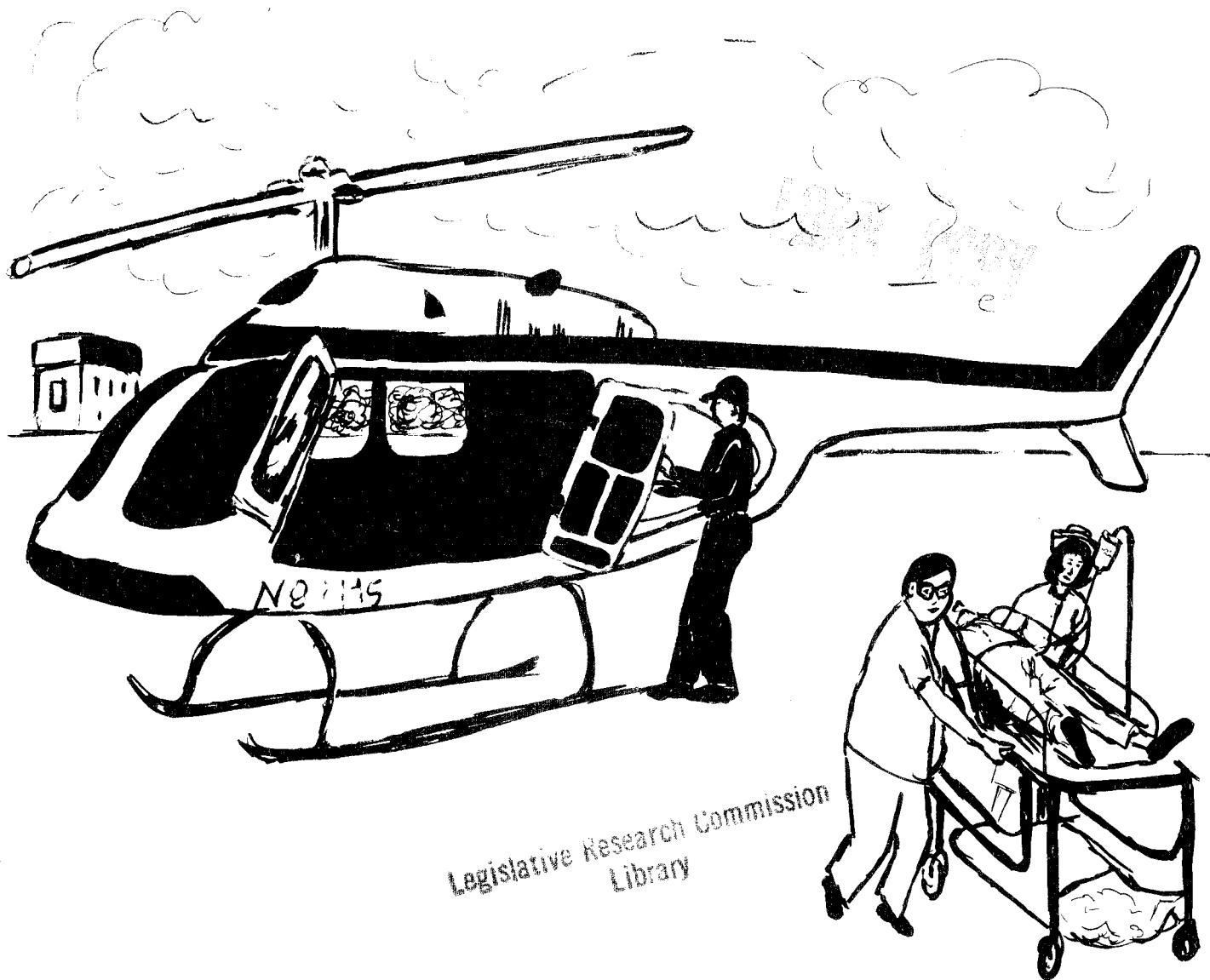


THE FEASIBILITY OF AIR AMBULANCE SERVICE IN KENTUCKY



RESEARCH REPORT NO. 184

LEGISLATIVE RESEARCH COMMISSION
Frankfort, Kentucky

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THE FEASIBILITY OF AIR AMBULANCE SERVICE IN KENTUCKY

Prepared by:

Norman Lawson

Research Report No. 184

*Legislative Research Commission
Frankfort, Kentucky
September, 1981*

Legislative Research Commission

FOREWORD

The 1980 Senate Joint Resolution 8 directs the Legislative Research Commission to "study the feasibility of air ambulance service in Kentucky" and to make recommendations thereon with regard to types of aircraft, training of personnel, medical problems, and other matters.

The report was prepared by J. Bruce Simpson and Norman W. Lawson, Jr. The cooperation of the Departments of Finance, Human Resources, and Military Affairs, the Division of Aeronautics, and the Kentucky State Police is gratefully acknowledged.

Vic Hellard, Jr.
Director

The Capitol
Frankfort, Kentucky
September, 1981

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SUMMARY

The following study considers the feasibility of air ambulance service in Kentucky, in terms of such considerations as funding, logistics, equipment, regulation, and location, and makes the following recommendations:

1. Air ambulance service for Kentucky appears to have the potential for being self-sustaining, in terms of the numbers of patients who may be air-transportable if a hospital-based helicopter operation is chosen. This potential is reduced if a substantial number of the patients transported are indigent and the state must pick up the bill, not only for the transportation but for the ensuing medical care.

2. Regardless of the options chosen, it is desirable for the current Military Assistance to Safety and Traffic (MAST) programs to continue at Ft. Knox and Ft. Campbell and, where possible, for state financial and equipment support to continue to these programs. Through these means portions of Western Kentucky can have services which the state could not economically provide from Louisville or Lexington.

3. The medical focus of the program should be centered in University Hospital in Louisville and Albert Chandler Medical Center in Lexington. No adequate program can be undertaken without the full medical support these institutions can provide. Arrangements must be made at each hospital for quartering of pilots and for a helipad for the landing of helicopters.

4. Hospitals throughout the state which have not already done so should be encouraged to install helipads to facilitate the implementation of an effective air ambulance program.

5. Initially, it might be better to have a hospital-based air ambulance program, using leased helicopters and pilots, so that if the program is not financially successful, it could easily be dropped at the end of a year or two. The hospital-based program would be better able to recover and balance the costs of operation of the air ambulance program through charges made to the patient, and thus reduce and, within a short period of time, eliminate the necessity of state funding of the air ambulance operation.

6. To accommodate the needs of the state police (as shown in the KSP proposal, Appendix 10.) and the medical needs of Eastern Kentucky, it would appear that two helicopters would be needed. The program could be workable if one helicopter were at all times stationed at the hospital, with its crew, with the second being available for police use. Savings can be realized from multiple use of the helicopter, but in order to provide adequate medical coverage, a 24-hour-per-day, 7-day-per-week operation is essential. Some of the costs of operation could be defrayed by making charges to the patient for transportation or by a cost-sharing arrangement, with the hospital returning some of the revenue from the air-transported patients.

7. The state-operated helicopter or air ambulance service should not be subject to the provisions of KRS Chapter 216B, relating to certificates of need and licensure, or to 902 KAR 20:115, relating to ambulance operations, but should be operated in conformity with Part 135 of the Federal Aviation Regulations and, as far as possible, with the provisions of the proposed medical portions of Part 135.

8. In order to ensure that air ambulance service does not become a financial burden to the Commonwealth, initial funding to the Universities for air ambulance costs should not exceed \$500,000 to \$600,000 for each university for the first year of operation, and not more than one-third to one-half of that figure during the second year of operation. No funding should be provided thereafter. During the period of state funding, detailed cost, revenue, and financial and medical data should be provided to the Department of Finance and to the Legislative Research Commission, so that the progress of the program can be closely monitored.

9. The air ambulance service should have no geographic limitations regarding where patients may be boarded or discharged, whether in-state or out-of-state, provided that out-of-state flights do not reduce the capability of providing medical care for the state. In any program, occasional out-of-state flights to such areas as Cincinnati, Evansville, or Nashville are medically necessary. The air ambulance programs in Lexington and Louisville should operate primarily within the service areas of their respective hospitals but should be permitted to go anywhere in the state when they are needed, at any time, without restriction. Both services should back each other up in times of emergency or aircraft unavailability and should, as far as possible, have programs which are compatible with each other.

10. No flight should be made without a physician or flight nurse on board, unless the purpose of the flight is pilot training. The base hospital should be responsible for the initial and refresher training of all medical personnel in the air ambulance program and should monitor the progress of the program. Additionally, the base hospital should provide all medical equipment and supplies that are not a part of the lease agreement and crew space for the helicopter pilots and maintenance personnel.

11. Operation by the National Guard or by state agencies other than the State Police is not recommended. Operation by the National Guard may violate Army regulations. Operation by agencies other than the State Police would cause tremendous communications and alerting problems and greatly increase the cost of operation.

12. The air ambulance service should respect traditional medical referral patterns and the wishes of the sending physician regarding which hospital a patient will be taken to. However, in the event the patient is not taken to the base hospital of the helicopter, arrangements should be made with the receiving hospital to reimburse that part of the cost of operation of the air ambulance service not covered by charges to the patient.

13. Pilots chosen for the air ambulance operation should have a minimum of two thousand hours of rotor wing time, with at least five hundred of those hours being night flying, regardless of whether they are hired directly by the hospital or are provided by a leasing firm.

14. If within two years the air ambulance program cannot become self-sustaining, a reevaluation should be made to determine whether it should continue. If it cannot be made self-sustaining, the operation should be dropped until such time as conditions indicate that it should be reinstituted. Costs in excess of \$1 million per year to the state are not justifiable if they are not recoverable in some form. The backbone of medical transportation in the state is, and will continue to be, the ground ambulance; enthusiasm for an air ambulance operation should not be allowed to detract from this service.

CHAPTER I

INTRODUCTION

At the 1980 regular session the General Assembly directed that the Legislative Research Commission, in cooperation with the Departments of Human Resources, Transportation, Military Affairs, and Natural Resources and Environmental Protection, study the feasibility of helicopter ambulance service in Kentucky and answer several questions with regard thereto.

Initially, it must be pointed out that helicopter or other air ambulance service is feasible, as it is currently being carried out by the military, by other states, and by private hospitals. Thus, it is possible for Kentucky to have such a service. Whether it may be economically sound to do so or whether the service can be effective, either financially or medically, rests on the answers to the other questions posed by the study resolution:

Who should operate it?

Where should helicopters be based?

What helicopters or other aircraft should be used?

How should helicopters be equipped?

Who should maintain the helicopters?

How should pilots and crews be trained?

How should the service be regulated?

What costs are involved?

What medical training must be given and by whom?

What other factors and recommendations should be considered?

Granting that the service is technically feasible and assuming a desire to provide such a service, the study will focus on how that can be most practically and economically accomplished.

Initially we must consider what an air ambulance service is and what it does, as well as some of the possible benefits of such a service - What is an air ambulance service and what would it do? What will air ambulance service do that ground ambulance service won't?

During the care and treatment of any victim of a medical problem it is frequently necessary to transfer that victim from one level of care to a "higher" level of care. This is due to the fact that many medical specialties, from orthopedics to neurosurgery to specialized cardiac care, are not equally available in the state. This does not imply that physicians in some parts of the state are less skilled than others, but merely refers to the distribution of medical specialists and specialized medical equipment which none but the largest hospitals can afford. For certain specialized care a victim is normally transported from a local medical facility to a regional

facility or to one of the two major medical centers in the state, located in Lexington or Louisville.

Currently most of these transports are made by ground ambulance. Ground ambulance service is available in every Kentucky county and is of excellent quality, but the ambulances are for the most part staffed by emergency medical technicians with only 87 hours of training in care and transportation of the sick and injured. In a few of the larger communities, paramedics, with over 1,500 hours training, are available for the most critical cases. However, ground transport of patients poses problems for the patient, for the ambulance attendant, for the ambulance service, and for the community in general.

The most efficient use of the ground ambulance is taking the patient from the scene of the emergency or illness to his local hospital or some other medical facility. There the patient can be stabilized by the local physicians and initial treatment can begin. The ambulance can be back in service and protecting the community within a relatively short time. The problems come when the condition of the patient demands that he be transported from, say, Whitesburg to Lexington or Russellville to Louisville for specialized care available only in those locations. In this case the normal course of action is to rely on the local ambulance service (either public or private) to transfer the patient to his new hospital.

When the transport is undertaken the physician sending the patient to the other hospital must decide whether or not he or another physician or nurse should accompany the victim or whether he can be safely transported by the emergency medical technicians (who are not permitted to administer intravenous solutions, drugs, or perform other advanced life-support techniques). If he does decide to send a physician or nurse, the medical resources of his community are depleted until the ambulance returns to the local community.

Time is also a factor. For many victims rapid transportation is essential to survival, yet in most cases, particularly in eastern Kentucky, the ambulance may be limited by road conditions to 50-60 mph. Thus, a two hundred-mile transfer may take four hours one way. A helicopter, however, would have the advantage of being able to fly directly to the scene, thus cutting the mileage, and it would be able to do so faster. Assuming that the air mileage would be 150 miles, a helicopter with a maximum cruising speed of 125 miles per hour would be on scene in 1 1/4 hours and would have a 1 1/4 hour flight time to the base hospital. During this 2 1/2 hours the patient would normally be in the sending hospital an hour and fifteen minutes longer, benefitting from the medical care available there. But while in route to the receiving hospital he would benefit from the advanced life support provided by the physician or emergency nurse in the helicopter. Even if flying time were the same as ground transport time the medical care level would be higher. The base hospital, using physicians training in emergency medicine or other specialties, or skilled nurses, has more resources available than the local hospital, so the medical resources of the sending community are not depleted.

During the period of time of the transfer, in this case eight hours on the road, and for the time required to situate the patient in his new hospital, the ambulance is not available in the sending community, necessitating that another ambulance and crew be available to provide protection to that community. Several ambulance service directors with whom the author has spoken said they would welcome not having to make lengthy out-of-town transfers because they operate what they feel is primarily an emergency service and their resources are too limited to permit frequent lengthy transfers.

There is a popular belief that the introduction of a helicopter ambulance service would mean that helicopters would be picking patients up off the road and transporting patients directly to a specialized medical facility, as is done by the state police in some portions of Maryland and by the military in combat. While some small percentage of patients may be aided in this manner, the overwhelming evidence from the Military Assistance to Safety and Traffic (MAST) units in Kentucky, which provide air ambulance service in the Ft. Knox and Ft. Campbell areas, indicates that the vast majority of cases are inter-hospital transfers and the distances involved are so great that in nearly every instance the patient would first have been taken to the local hospital by his local ambulance service. Time, distance, and money are the factors that mitigate against an exclusively airborne ambulance service in Kentucky. The success of the military operation in Vietnam was due to the fact that over a thousand helicopters were available to take the wounded to specialized hospitals located strategically throughout the country and the area of response for each aircraft was relatively small.

The distribution of ambulance services and hospitals in Kentucky is such that a person in most areas of the state can be in a hospital in about thirty minutes from the time the call for service is received. Thus, the patient is in the hands of a trained emergency medical technician within five to fifteen minutes and is in the medical facility a short time thereafter. The expense of duplicating this system by helicopter or other aircraft would be enormous and would not provide any substantial advantage to the patient over the present system. The primary benefit of the air ambulance operation is to transfer the patient to a higher level of care or to specialized facilities.

The main drawback of any air ambulance service, whether conducted with light fixed-wing aircraft or helicopters, is the cost of the service. For the price of one helicopter one can purchase ten to fifteen well-equipped ambulances. Operating costs are also high, being estimated by the Kentucky State Police at \$200 per hour. In an efficient service a balance must be struck between cost and the size and benefits of the service. If possible, the service should be self-sustaining after a relatively short period of time through charges made for the flights, increased revenue to the receiving hospitals, or through multiple use of the helicopters to realize the maximum utility for the dollars invested.

Another drawback cited for air ambulance service is that aircraft, helicopters included, cannot fly during fog and certain other weather conditions. In practice, throughout the country, and as indicated by the statistics of the military programs currently operating in Kentucky, five percent or less of flight requests must be refused due to weather.

In summary, air ambulance service offers the patient a shorter trip between hospitals and the chance to be with skilled medical personnel longer; to the smaller community it offers rapid transport of patients needing a difference level of care and curtails the depletion of local resources during the time of the transfer.

In any consideration of a new medical service it is important to ascertain whether the volume of patients will justify the creation of the proposed service or facility.

Information on the number of transports by ground ambulance in the state is available but should be cautiously interpreted, since it only totals the number of transports and doesn't indicate whether they were short, in-town

trips, such as from a rest home to the hospital, or were longer transfers between cities, taking patients to a different level of care.

In the Western part of the state, statistics are available for Military Assistance to Safety and Traffic (MAST) programs at Fort Campbell and Fort Knox, in which military helicopters transport civilian patients for the neonatal transportation program at the University of Louisville (which uses both air and ground transport), and for counties in the Emergency Five emergency medical services region.

In 1979 the military programs transported 237 victims and the neonatal transport program brought 140 patients (69 by air and 71 by vehicle) to neonatal units in Louisville. During the three-month period from January to March, 1980, Emergency Five surveyed the counties in its region and discovered that 78% of the ambulance patients in the region were transported to a hospital. The number of patients transported from the county of origin to Louisville varied from 92.2% in Oldham County to 2.4% in Grayson County. On a regionwide basis 83.4% of the ground ambulance patients were transported from their home county to hospitals in Louisville. The study projected 2,386 transports from the fourteen counties (not including Jefferson) of Emergency Five to hospitals in Jefferson County. While these statistics do not represent more than a fraction of the patients transported in Western Kentucky or those to hospitals in Louisville, they represent a helpful estimate of the numbers of victims which might be anticipated for air transport. Louisville General Hospital did not keep complete records of the counties from which admissions were made in the past, but the University of Louisville, which has taken over the hospital, is now doing so.

In the Eastern portion of the state, the best figures come from the county-by-county admission data maintained by the Emergency Department at the University of Kentucky Medical Center and the neonatal transportation program operated by the Kentucky Army National Guard, which uses helicopters to transport high-risk infants to the neonatal unit at the University of Kentucky.

The University of Kentucky figures show a total of 18,958 admissions for the fiscal year 1979-80, with 5,431 of those being from Fayette County, leaving 13,527 admissions from other locations within Kentucky. Additionally, there were 484 admissions from out of state. While neonatal transport program figures are presumably included in the above totals, a further breakdown of the figures shows 3,410 infants admitted from outside of Fayette County during the period studied.

No attempt was made to obtain figures from other hospitals in the Lexington or Louisville area, except as indicated in this study, so as to present an accurate picture of those patients currently being received by those facilities which might be the base hospitals for a helicopter ambulance service.

In Eastern Kentucky, if only 5% of the present cases were air-transported to the University of Kentucky, 676 transports could be expected during an average year. Over 100 air transports of infants alone are currently being made with no coverage for adult air transportation in Eastern Kentucky. In the area immediately surrounding Louisville, using the same 5%, 119 cases would be transported. Already, 200 to 300 patients are being air-transported within the Western portion of the state by the MAST units and the neonatal transport program. From the available information it would not be unreasonable to assume that perhaps two flights per day could be made by each of the

helicopters which could be based at the University of Kentucky and the University of Louisville.

CHAPTER II

WHO SHOULD OPERATE AN AIR AMBULANCE SERVICE?

In considering who should operate an air ambulance service it is first necessary to examine the current situation in Kentucky, since the base for a program is already in place, through programs operated by the military, the National Guard, Louisville General Hospital, and proposals by private operators. Thus, the answer to this question will explore the services currently being rendered, the nature of the services, and prospects for their continuation. The second portion of the answer to the question will explore how a continued and expanded service should be approached.

Detailed data concerning mission logs, showing types of transports, number of transports, and similar information, is on file in the Legislative Research Commission Library at the State Capitol Building in Frankfort, Kentucky.

Existing Programs

At the present time there is a fair amount of transportation of adults and infants by air in aeromedical situations in Kentucky. Basic air ambulance service is provided by Military Assistance to Safety and Traffic (MAST) units of the U. S. Army located at Ft. Campbell and Ft. Knox. MAST units are federally funded with some state and local financial and equipment support. Under the MAST program military helicopters and military medical and aviation personnel assist civilians who have been injured or who are ill, on the basis of a request from competent medical or law enforcement personnel. The program is justified from the standpoint of additional actual missions for the military personnel, which help keep their skills needed for military missions at a high state of readiness, and by the desire of the military to assist the civilian population. MAST missions are of necessity limited to those instances where the mission will not interfere with military operations or readiness and where sufficient funding is available to cover the costs of operation. MAST is not a mandated program for any military unit; it is a service undertaken by that military unit over and above all of its military duties. Thus, in certain instances, MAST helicopters and crews may not be available, due to military mission commitments. This would certainly be the case in the event of war or any military conflict to which the unit might be assigned.

Specialized air ambulance service for newborn infants is provided in eastern Kentucky by the Kentucky National Guard, under a contract with the Department for Human Resources. A similar service is provided by the University of Louisville and Kentucky Flying Service in Louisville for infants in western Kentucky, through another contract with the Department for Human Resources.

Matt Simpson, president of Air Lexington, an air charter service certified by the Federal Aviation Administration, has proposed a commercial air ambulance service, primarily for eastern Kentucky, using light fixed-wing aircraft rather than helicopters. Air Lexington is in the process of obtaining a certificate of need to operate an air ambulance service.

At present various other air charter companies, both in state and out of state, offer air ambulance service in their advertising, but none has obtained

from the Commonwealth of Kentucky a certificate of need or license to engage in such operations.

Fort Campbell MAST Unit

The 326th Medical Battalion (Helicopter Ambulance), popularly known as TIKI MAST (the initials standing for the states of Kentucky, Indiana, Illinois, and Tennessee), has been involved in the MAST program since 1975. During that time 675 missions have been flown in Kentucky. The unit is on 24-hour alert status, with one helicopter and crew ready to fly at all times.

The unit's UH-1 Helicopters normally respond to requests for service within 100 air miles of Fort Campbell. Service is provided to civilians without charge and the costs of the operation are borne by the army. Certain radio, medical, and other equipment has been provided by the Commonwealth of Kentucky, primarily to ensure effective communications with civilian medical facilities and compatibility of medical equipment.

The vast majority of the unit's missions involve transfers of patients from an outlying hospital to a hospital offering a higher level of care or specialized facilities. A large number of transfers are made to Nashville, Memphis, Louisville, Hopkinsville, and Paducah. Blood transfers account for the second largest number of missions, with Nashville and Fort Campbell area hospitals being the most common pickup sites.

Analysis of the 692 missions in Kentucky shows that 536 flights involved patient transfers and that most involved a single patient. Only twelve missions involved the pickup of a victim at the scene of a vehicle accident, while six additional missions involved search and rescue. Due to the presentation format of the statistics, total flight hours are not recorded. Arrival times to nearby locations, such as Mayfield or Bowling Green, were an hour or less, with response times as little as 11 minutes (for an auto accident in Hopkinsville). Most other arrival times were under two hours, except in those cases where the flight was scheduled in advance.

Fort Knox MAST Unit

The 431st Medical Detachment (Helicopter Ambulance) has been involved in the MAST program since 1975. During that time over 1,100 missions have been flown in Kentucky. The unit is on 24-hour alert status, with one helicopter and crew ready to fly at all times.

The unit's UH-1 Helicopters normally respond to requests for service within 100 air miles of Fort Knox. Service is provided to civilians without charge and the costs of the operation are borne by the Army. Certain radio, medical, and other equipment has been provided by the Commonwealth of Kentucky, primarily to ensure effective communications with civilian medical facilities and compatibility of medical equipment.

The vast majority of the unit's missions involve transfers of patients from an outlying hospital to a hospital offering a higher level of care or specialized facilities. A large number of transfers are made to Louisville General Hospital, Jewish Hospital, and Norton Children's Hospital. There are also a large number of missions involving the transfer of blood from Louisville to hospitals throughout western and central Kentucky. A lesser number of flights have transported kidneys, eyeballs, and other organs for transplant.

Analysis of the data from the unit shows that nearly all flights involved a single patient. The shortest flights involved accidents and other problems in the immediate area of Fort Knox, with the patients being transferred to Ireland Army Hospital on the base, with a total flying time of about thirty minutes. The longest flights of Kentucky origin were of 6.7 flight hours, transferring patients from Allen County Hospital at Scottsville to University of Kentucky Medical Center, and from Appalachian Regional Hospital at Whitesburg to the University of Tennessee Medical Center at Knoxville. These flights, well outside of the normal operating radius of the MAST unit, account for but a small number of the total flights. Most of the flights consumed two to four flight hours. It must be remembered that the calculations of flight time include the flight from Fort Knox to the facility where the patient is picked up, the flight to the receiving facility, and the return to Fort Knox.

Out of the 1,110 reported missions only 22 were cancelled or aborted. Typical reasons for these few cancellations were weather, patient transported instead by ground ambulance, patient worsened or died before arrival, or the requestor cancelled the mission. Weather accounted for less than half of the cancellations.

Kentucky Army National Guard Neonatal Transport Program

The Kentucky Army National Guard operates a neonatal transport program in cooperation with the Department of Neonatology at the University of Kentucky Medical Center, under a contract between the University, the Guard, and the Department for Human Resources.

Under the agreement the National Guard is to supply helicopters and personnel from 8:00 A.M. to 4:30 P.M. Monday through Friday - although flights have been made outside of these hours and on weekends, depending on available personnel. The Guard supplies UH-1 helicopters which have been fitted for state emergency medical services and contain hospital radios and a portable incubator for the infants. It also supplies a pilot, copilot and aircrew member for each flight. The University of Kentucky supplies the physicians or nurses required for the flight and all necessary medical equipment. Normally the helicopters land at the University of Kentucky practice football field, pick up the medical personnel, and then fly to the sending hospital to pick up the infant. The vast majority of flights are to Lexington, where the helicopter again lands at the practice field; it is met there by a ground ambulance, which transfers the infant and medical personnel to the hospital.

During fiscal year 1979-1980, sixty-three flights were made, primarily to eastern Kentucky, with an average of 2.595 hours of flying time per mission. During this time three missions were aborted, due to weather conditions, and one due to unavailability of fuel. During the fiscal year only one patient died en route.

On April 24, 1980, the Department of Military Affairs submitted a budget for FY 1981 of \$120,315, with the bulk of the moneys to go for weekend crews (\$34,380), mechanic to augment full-time maintenance crews (\$16,800), weekday crews (\$28,650), fuel costs (\$21,240), and spare parts (\$13,275).

Flying the UH-1 helicopters was estimated to take eighty gallons of Jet A fuel per hour, at \$1.18 per gallon. Spare parts costs were estimated at \$59 per flying hour. Thus, bare minimum operational costs for fuel and spare parts come to \$153.40 per hour, without the cost for pilot and crew.

Norton-Children's Hospital High-Risk Infant Transportation Program

The Department for Human Resources, Norton-Children's Hospital, the Department of Pediatrics at University of Louisville Medical School, and the Kentucky Flying Service in Louisville jointly operate a program for the transport of high-risk infants from all of the western portion of the state to Louisville for specialized care and treatment.

The transportation is by specially equipped ground ambulance or by light twin-engine aircraft in which the neonatal isolette and other equipment may be placed. The Cessna C-401 and Piper Aztec are the aircraft used. No helicopters are used in the program, as the director of the program, Dr. Roger Shott, does not feel that the helicopter is a suitable means for transportation of high-risk infants.

During 1978, sixty-four vehicle trips were made. The year 1979 saw sixty-nine air transports and seventy-one vehicle transports, while data for 1980 through June showed sixty-five air transports and fifty-one vehicle transports, with a budget request for 130 air transports and eighty ground transports for 1980-81. Available data shows a total of 12.7 transports per month in 1979 and 19.1 transports per month in 1980, with slightly less than half of the transports by air in 1979 and slightly more than half by air in 1980.

Since fixed-wing aircraft are used, a ground ambulance must transport the infant from the hospital to the nearest airfield capable of landing the light twin-engine aircraft. Then the aircraft flies to Louisville, where another ground ambulance transfers the infant and medical personnel to the hospital. The total cost of the operation during 1979 was \$96,856.

Under this program the aircraft are provided by Kentucky Flying Service of Louisville, which also provides the pilots. Thus, the state has no investment in the aircraft, and does not provide direct maintenance costs or pilot salaries.

According to the schedule provided, typical flying times from Louisville are as follows: Ashland - 1:05; Bardstown - 20; Covington - 40; Frankfort - 20; Fulton - 1:25; Lexington - 30; Paducah - 1:20; Pikeville - 1:15; and Stanton - 50. As can be seen, flying times for the light twin-engine aircraft are much shorter than for the average helicopter and the refueled range is much longer.

Who Might Operate An Aeromedical Evacuation Service?

Operators of aeromedical evacuation services throughout the country vary. Some services are operated by the military under the MAST program described earlier, which has participants at Fort Campbell and Fort Knox.

In the realm of public operation by states the State Police seem to be the first choice. The service is usually provided without cost to the patient. Illinois has chosen to operate helicopters owned by the Departments of Transportation and Public Health to transport patients to regional trauma centers throughout the state.

Ohio has chosen to utilize the National Guard, at least on a part-time basis, in its "Doctor Copter" program, while Kentucky utilizes the National

Guard in neonatal transportation from eastern Kentucky.

The largest number of successful services are hospital based and use leased helicopters and pilots and maintenance personnel. Medical personnel come from the sponsoring hospitals. Nearly all of the hospitals are private facilities and presumably would not be offering air ambulance service if it were not a paying proposition. A list of typical hospital air ambulance services is appended hereto. While most of the hospitals have helicopters of various models, some of the larger and better-established programs use fixed-wing aircraft as well.

Throughout the nation various private air taxi and air charter operators certified under FAR Part 135 offer varying qualities of air ambulance service, normally using fixed-wing aircraft, occasionally using helicopters. The quality of the service has varied so widely that the Federal Aviation Administration once proposed a uniform set of minimum standards for such operators, but due to various forms of opposition the regulations never went beyond the proposal stage. A voluntary set of standards is currently under study by the American Medical Association, but these are not yet available in final form.

For the present study letters were sent to the Kentucky State Police, the Department of Military Affairs, and the Department of Finance, to determine the level of interest in air ambulance service being operated by each agency (with the understanding that there would be no guarantee of forthcoming funding). Communication was also made with the University of Kentucky and University of Louisville. Descriptions of similar programs in other states and the responses from the agencies and universities are presented below.

Table 1

States With One Or More Agencies
Operating Ambulance Helicopters

ARIZONA	IOWA	OKLAHOMA
CALIFORNIA	KENTUCKY	OREGON
COLORADO	MARYLAND	PENNSYLVANIA
DELAWARE	MICHIGAN	SOUTH CAROLINA
DISTRICT OF COLUMBIA	MINNESOTA	TENNESSEE
FLORIDA	MISSISSIPPI	TEXAS
IDAHO	MISSOURI	WASHINGTON
ILLINOIS	NEW YORK	WEST VIRGINIA
INDIANA	NORTH CAROLINA	WISCONSIN

Operation by State Police

In any consideration of a statewide air ambulance operation, either using fixed-wing aircraft or helicopters, maximizing the use of costly aircraft is important to lowering the per-unit cost of delivering the service. Unless a means is found to defray the costs of operation of any aviation program, reserving aircraft, personnel, and equipment for a single mission can mean cost-effectiveness problems.

In order to remain cost-effective and still maintain twenty-four hour emergency response, several states (twelve responding to an LRC survey of state police agencies) have chosen to locate the air ambulance function within their state police agencies. Two of the states, Virginia and West Virginia, indicate that the use of state police aircraft or helicopters for such purposes is limited or is basically a support role when other resources may be exhausted.

A state police agency would typically use the aircraft for criminal enforcement, traffic surveys, aerial photography, search and rescue, dignitary transportation, insertion of special police teams, and training, as well as aeromedical evacuation. Thus, the aircraft is utilized frequently enough to justify high procurement or leasing costs. The biggest problem here is defining which is the primary role of the aircraft and ensuring its availability for such missions. If the aircraft is being utilized for traffic survey and control, there is little doubt that it could be diverted for a medical mission, but if it is the key element in a high speed chase of a murderer, the question of priority may be more difficult. One mission or the other must then suffer from the unavailability of the aircraft. Similarly, even though the aircraft could be released from another mission to fulfill the medical role, its original mission might have extended its effective response time.

Aircraft reported to be used by the various state police organizations included the Bell Jetranger and Longranger, the Bell UH-1E (obtained as government surplus), the Hughes 500, and the Sikorsky H-34. Other helicopters are used by such organizations but they are generally smaller observation models unsuited for the transportation of victims.

Most of the state police agencies responding to the survey with comments reported that specialized training is given to the officers who accompany the helicopter. Arizona, Delaware, Maryland, and New Jersey all reported that their officers were trained to the Emergency Medical Technician Level, which requires eighty-seven hours of training (in Kentucky) and recertification every two years. Arizona and Maryland report training officers to the Paramedic level, requiring approximately 1,500 hours of training.

Several states, such as New Jersey and Missouri, operate in cooperation with nearby medical facilities, which provide physicians or nurses to accompany the victim. Depending on how the program is operated, this practice may increase the response time, since the helicopter must first fly to the medical facility and then to the scene of the emergency, if an on-site pickup is to be made. This factor becomes less critical in patient transfers from one hospital to another, where the sending facility may provide the physician or nurse to accompany the patient, or where the receiving facility provides the personnel and the patient has been stabilized at the sending hospital so that the time spent in picking up medical personnel is less critical.

Another concern that arises in the pickup of medical personnel (unless

they are picked up and returned to the receiving institution) is how the personnel will return to their original hospital. This is a complaint that has sometimes been voiced with regard to military helicopter flights in Kentucky, because there are times when military necessity means that the aircraft must return immediately to its base, thus stranding physicians and nurses.

One advantage that the State Police normally possess over other state agencies which operate aircraft is a well-functioning communications system designed to reach all parts of the state, meaning that the helicopter or other aircraft would normally be within communications range. In Kentucky this communications network is further improved by the existence of the Kentucky Early Warning System (KEWS).

At present the Kentucky State Police operate two single-engine Cessna aircraft for general law enforcement and traffic duties. Occasionally, the aircraft have been used for blood transportation and other related duties but they are not used for aeromedical transportation.

In response to a query from LRC staff, the State Police have stated that if they performed an aeromedical evacuation function in conjunction with existing programs, the program could be accomplished with two helicopters placed "as close as physically possible to the University of Kentucky Medical Center in Lexington." They suggest coverage for eastern Kentucky primarily because the coverage afforded the western portion of the state by the MAST units at Ft. Knox and Ft. Campbell is adequate.

Projected cost figures for the program as operated by the State Police would be \$327,000 for each helicopter, \$20,000 average salary for each of three pilots, \$312,000 operating and maintenance costs for each helicopter (based on 30 hours of flying per week, at \$200 per hour) and approximately \$6,000 to \$10,000 per pilot for training. Medical personnel, under the State Police proposal, would be provided by the University of Kentucky Medical Center in the same manner as they are now provided to the National Guard for neonatal transfers.

As with other State Police agencies, the Kentucky State Police recommend utilization of the helicopters for other police missions when not in use for medical missions. This approach would permit the cost to be shared by several programs. No mention is made in this State Police communication as to whether charges would be made to the users of the service. It would be consistent with the operation of other state police aeromedical evacuation programs throughout the United States if no such charge were made.

Perhaps the most publicized police-operated program is that of the Maryland State Police. Since the program is highly regarded it is appropriate to discuss it in more detail and point out some of the features of the operation, at the same time noting how Maryland's needs differ from Kentucky's needs.

Maryland State Police have been engaged in helicopter operations since 1960, but the major emphasis on aeromedical evacuation began in 1968:

The idea was to enhance severely injured automobile accident victim's chances of survival by getting them from the accident site to a Trauma Treatment Center as quickly as possible - hence, the role of the airborne helicopter ambulance in America was born. (Annual Report, 1978, p. 1.)

In 1969 less than 100 patients were transported; in 1970, 197 were transported, with an 88% survival rate, compared to a 40% survival rate from trauma in other hospitals, according to the State Police. Despite setbacks, such as hull damage in collision with overhead wire in 1971, a fatal accident in the fog in 1971, and a fatal collision while hovering in 1972, the safety and training program was increased and pilots were upgraded to certified flight instructor status. Aircraft were gradually increased until in 1978 there were four Bell 206B Jetrangers, eight UH-1B "Huey's," two Sikorsky H-34J's, and a twin-engine Piper Navajo. Jetrangers served as the primary aeromedical evacuation aircraft and were purchased new, with the aid of federal grant moneys. The UH-1B's and H-34J's were obtained as military surplus through Civil Defense channels. Forty-nine uniformed personnel are assigned to the program and there is a full-time maintenance staff of seven.

Medical training of State Police personnel assigned to the helicopters, according to the 1978 annual report, consists of eighty-one hours of training as emergency medical technicians; eighty hours of on-the-job training at the Maryland Institute for Emergency Medicine, Shock Trauma Unit, in intravenous therapy, MAST (antishock) trousers, esophageal obturator airway insertion, and similar matters; two days on-the-job training at Baltimore City Hospital's Premature Baby Intensive Care Unit and Burn Treatment Center, and yearly retraining in all related emergency care fields.

In 1978 there were four operating bases for the helicopters scattered throughout the state, each with a thirty-mile operating radius, ensuring the ability to transport victims to a nearby trauma center or hospital facility. As of that time there was little coverage in western Maryland, but additional units were planned as trauma centers were implemented in regional hospitals. In contrast to current statistics in Kentucky, where hospital-to-hospital transfers account for most of the aeromedical evacuation load, Maryland shows for 1978 that 51.5% of the missions were on-scene pickups, 23.7% hospital-to-hospital transfers, 20.1% neonatal transfer, 4.7% other types of transfer, including blood, serums, and organs.

In Maryland the State police are free to use the helicopters for all other law enforcement purposes when they are not in use for aeromedical evacuation purposes. They account for approximately 100 felony arrests per year. In 1978, 37% of the flight hours were for transporting and 37% for traffic control. A significant portion of the 4,898 flight hours during that year, then, was devoted to purposes other than medical evacuations. Among the routine daily duties for the helicopters is traffic control in the morning and afternoon rush hours.

Certain features of the Maryland program may not be applicable in Kentucky. There is generally not a suitable trauma center within 30-60 miles of a possible helicopter base. Kentucky has an excellent ground ambulance program, capable of transporting persons from the scene to a local hospital faster than a centrally dispatched helicopter would, in most instances; thus on-scene pickups may not play the role they do in Maryland.

Operation by National Guard

Operation of an air ambulance service by the National Guard, which currently operates a portion of the neonatal transport program, may seem to be a viable alternative, but there are several limitations to consider:

1. National Guard aircraft and personnel are primarily in place to ful-

fill a military mission. Air ambulance and rescue missions are flown only when military missions are not being undertaken and personnel are available.

2. Fulfilling the requirements of the neonatal program has resulted in calling personnel to state active duty at considerable expense to the state.

3. A large number of ambulance flights would mean greater fuel and maintenance costs for the military-owned helicopters and would lessen the availability of the aircraft for military needs.

4. The National Guard, after study, has concluded that it may be illegal to provide air ambulance service on a continuing basis, because Army Regulations prohibit competition with private enterprise.

5. Provision of the service, according to the National Guard, would call for a minimum of one aircraft, two maintenance technicians, eight aviators, and four trained medical personnel technicians. It is likely that these requirements may be necessary any way the program operates, unless full-time pilots are hired, in which case fewer pilots would suffice.

The text of the reply received from the National Guard is Appendix 9.

Hospital-Based Programs

At least thirty-seven hospitals in twenty states operate air ambulance programs utilizing helicopters or helicopters and fixed-wing aircraft (see Appendix 7).

One reason helicopter ambulance service is attractive to hospitals is the revenue that can be generated from the service. Transportation charges are billed to the patient on his inpatient bill if he is transported to the sponsoring hospital, and on the outpatient bill if he is transported to another hospital. Due to the seriousness of the cases, Rocky Mountain Helicopters tells potential clients, the "Average helicopter patient stays 3 to 4 times as long, and generates 2 to 3 times as much revenue as average patient." Also billed are nurse or physician services during the flight, medical supplies used during the flight, and similar charges.

A case in point, R&WI (Rotor and Wing International) quickly found out, is David Smith, director of West Jefferson Hospital in Marrero, La., across the river from New Orleans. He told us that his hospital began using a Bell LongRanger II in April of last year; the aircraft under contract from Air Logistics of Lafayette, La.

In its first month, the ship carried four patients, but by the end of the year, it was averaging about one a day. Between April and December, West Jefferson's LongRanger brought in 212 patients and 'they produced right at \$1 million in new revenue for us,' said Smith. 'Most all of it was paid, too. Bad debt was only about 2.3%. You see, most of these are industrial injuries. The area we service is primarily the oil industry, shipyards, fabrication plants and so on, so most of these are covered by some type of workers' comp.' (June 1980, p. 43.)

A recent article entitled "Air Ambulances-What Took So Long?" (Emergency, August 1980, p. 53) had this to say about the profitmaking potential of the

helicopter:

As it turns out, air ambulances, unlike highway ambulances, receive no direct government funding. The cost of supporting Life Flight is entirely borne by private funds. Caroline Bear, Life Flight's Program Director, explains how the system works. 'The program cost is entirely patient self-sustaining, or at least will be soon,' Bear reports optimistically. 'A patient is billed a flat \$100 fee plus one dollar a mile round trip. The average \$200 fee, with just over one flight per day, hardly pays for the helicopter's windshield cleanser, let alone the full operating costs.'

What pays for Life Flight, Bear explains, is the additional fees brought in by the new patients, who, if it were not for Life Flight would likely be taken into another hospital. Since marginal hospital costs are but one-third the fees hospitals charge, each new patient represents a big income. A burn patient for example, might pay a fee of \$150,000, thus profiting the hospital a cool \$100,000. 'We only need to get a handful of new patients to pay hospital costs,' acknowledges the Life Flight Director.

Other benefits which interest the hospitals include increasing the census of patients, more use of specialized medical equipment, additional training for nurses and physicians in medical and nursing training programs, and an attractive program to recruit new hospital physician and nursing personnel.

One of the prime features of increasing the patient census is that it reduces the hospital's standby cost losses and provides revenue to cover fixed operating costs.

For the benefit of the citizenry it is important that air ambulance service be operated by a hospital or consortium of hospitals capable of providing the necessary specialized medical or rehabilitative care the patient requires on a 24-hour-a-day basis. Rapid transportation of a patient to a hospital not fully capable of providing for the patient's needs, while perhaps a revenue builder for the hospital, is not in the best interest of the patient. Most of the hospitals operating air ambulance service recognize this and will provide air transport to any hospital the sending physician suggests, provided it is within the range of the helicopter. Thus, traditional referral patterns are honored and the patient receives the specialized care to which he is entitled. Flight for Life in Denver reports transporting 40% of its patients to hospitals other than St. Anthony's.

With the large number of specialized medical facilities in Louisville and Lexington, helicopters operating from the University of Kentucky or University of Louisville should be able to provide patients to all of the hospitals in the area and to the major regional medical centers as well. The only problems might center in cost-sharing arrangements for those patients not transported to the base hospitals. Similarly, there should be little problem for in-state based helicopters to fly patients to nearby hospitals in surrounding states or, when not needed in-state, to pick patients up out-of-state for transportation to facilities in Kentucky. Out-of-state operations may require licensing by the surrounding states, however, particularly if patients are picked up out-of-state and transported to Kentucky on a regular basis.

Table 2

Hospital-Helicopter EMS Program Summary

The following is a summary of data collected from a 52% sample of hospital-based helicopter programs that have been in operation for one year or more in the United States. The average program profile is as follows:

Population within 50 miles of sponsor hospital	1,177,850
Number of beds of sponsoring hospital(s)	675
Annual transports:	370: 1st yr. 462: 2nd yr.
Monthly transports:	31: 1st yr. 39: 2nd yr.
Annual transports per 100,000	31
Percentage of transports to sponsor hospital	60%
Length of stay for helicopter transported patient	16 days
Total gross revenue per patient	\$10,000
Ratio of in-patient revenue to program cost	10 to 1
Percentage of transports within 50 mile radius	75%
Type of helicopter response: Hospital transfers	75%
Scene pickups	25%
Patient diagnosis: Trauma/Surgical	45%
Cardiac	15%
Other Medical	25%
High risk mother/infant	10%
Burns	5%
Helicopter response to requests: Completed	90%
Incompleted:	
Weather	5%
Other	5%

Note: Variance from averages shown may be considerable due to regional referral patterns, capabilities of sponsoring hospital, geography, and demographic influences.

Source: Rocky Mountain Helicopters, Inc.

Flight for Life. Hospital-based air ambulance programs have been in use for five to ten years now and the number of hospitals entering the air ambulance business is increasing. A typical program, among the leaders in the field, is that based at St. Anthony Hospital in Denver, Colorado. It operates under the name "Flight for Life." The program began on October 12, 1972, and now provides helicopter and fixed-wing transportation for all types of illness or injury and for neonatal patients.

Flight for Life began operations October 12, 1972. From that date through December 31, 1979, more than 13,000 flights were completed into more than 200 cities in 35 states, Canada, Costa Rica, and Mexico.

Flights have been made into more than 200 Colorado cities, towns and communities, serving user agencies and providing service to physicians in more than 100 hospitals throughout the State. Forty percent of all patients handled are delivered to other hospitals.

Emergency service has been provided in major ski areas in Colorado, and numerous rescue flights into wilderness areas at the request of various search and rescue teams, National Park Service and U.S. Forest Service officers.

Flight for Life operates 24 hours a day with two Alouette 316B helicopters and pressurized conventional aircraft ready for immediate response. (From descriptive brochure.)

Flights over 150 miles in length are made by twin engine turboprop Merlin aircraft, while lesser length flights are made in the Alouette helicopters.

The service has expanded from an average 2.61 flights per day in the first year of operation to 6.49 per day in 1979. Since the most complete information on the total program was received from this organization it is appended to this report as an example of typical operational details.

Involvement of University of Kentucky and University of Louisville Hospitals in an Air Ambulance Program

In any successful air ambulance program the patients must be transported to a medical facility capable of handling major trauma, cardiac, and other medical problems on a 24-hour-a-day basis, with laboratory and ancillary services backing them up on the same basis.

The Chandler Medical Center at the University of Kentucky and the University Hospital at the University of Louisville have been designated by the Department for Human Resources as the regional medical centers for their respective portions of the state, due to their vast facilities and staff and the capability of performing on a round-the-clock basis. It is likely that a large number of patients in any air ambulance program would come to these facilities, although any such program would need to respect traditional medical referral patterns. Both institutions have medical schools and have emergency medicine training as a portion of the available training for physicians. An air ambulance program could be a valuable adjunct to the emergency medicine training for physicians and could, of course, see higher level personnel attracted to the program.

Recognizing this, the present writer initiated discussions with Dr. Richard Braen, and his staff at the University of Kentucky and Dr. Donald Thomas and his staff at the University of Louisville, with regard to the air ambulance program and the willingness of their institutions to participate therein. Since both men head the emergency medicine programs at their respective institutions and are widely respected in the field of emergency medicine, it was felt that they could assess the need for the program and the willingness of their institutions to participate in such a program. Both agree that an air ambulance program could be beneficial to the Commonwealth in providing better medical care to the citizenry through fast transfer to a higher level of medical care, and at the same time be a valuable portion of the training of emergency physicians and emergency nurses. Through their intervention, letters of support have been obtained from the governing bodies of both institutions, not only for the program but for their agreement to participate in the program and to continue it on their own after a period of initial legislative funding, provided that the income generated by the program is sufficient to permit its continuation.

An evaluation of a hospital-based service by Dr. Mary Ann Cooper of the University of Louisville Department of Emergency Medicine is found in Appendix 5, which is stored in the LRC Library.

CHAPTER III

LOCATIONS, REGULATIONS, TRAINING

State Regulation of Air Ambulance Service

Presently, KRS Chapter 216B, the certificate of need and licensure law, regulates health facilities and services, including air ambulance services. The present regulations of ambulances (including air ambulances) are found at 902 KAR 20:115. These regulations, although they include air ambulances by their language, were designed solely for ground ambulance operations. Virtually no aircraft currently in air ambulance use meets the space or equipment carrying requirements of a ground ambulance. Further, much of the equipment on the ground ambulance is designed for extrication of victims from vehicle accidents and is unsuited for the mission of the air ambulance. Other equipment may be too large or too bulky for aircraft use. Normally, helicopters use a small aluminum stretcher similar to the backboard of a ground ambulance as the primary stretcher. The wheeled ambulance cot found in ground ambulances will not fit in the average helicopter.

The certificate of need provisions of the statutes would require a lengthy application and justification process for the establishment of the air ambulance service and could significantly delay the implementation of such a service. Since the service, if the General Assembly determines that it should be undertaken, most likely will be a state-operated and state-supported venture, compliance with the certificate of need procedure and the present ambulance regulations would be counter-productive. It is recommended that the statute setting up the air ambulance program provide an exemption from both KRS Chapter 216B and 902 KAR 20:115.

The statute authorizing the creation of the service should specify general guidelines under which the service should operate aeronautically, medically, and administratively, so as to assure a high quality service. Supervision of various parts of the program could be undertaken by such existing agencies as the Department of Finance or the Department for Human Resources. Following Part 135 of the Federal Aviation Regulations, as previously recommended, should provide for adequate supervision of the aviation portion of the operation, while adoption of the air ambulance regulations proposed as a portion of Part 135, or the as yet unpublished recommendations of the American Medical Association, should provide for adequate supervision of the medical aspects of the operation. Protections should also be built in, requiring accounting for the use of state funds provided for the service, the hospital's contributions, and operating costs and revenues, so that an adequate fiscal evaluation of the program can be made.

What a Hospital Would be Expected to Provide

Hospitals at the University of Kentucky and University of Louisville would be expected to provide a share of the operation of the service as follows:

1. Medical personnel to accompany the helicopter. Medical personnel would consist of emergency department nurses or resident emergency department

physicians. Normally, these personnel would be on the premises, with primary assignment to the helicopter during their tour of duty; they would otherwise be utilized for other tasks. In the event the primary personnel were on a mission and another mission was received, either the helicopter from the other hospital could be dispatched or, if additional aircraft were available, standby personnel could be called.

2. Non-installed medical equipment and medical supplies for helicopter use. Certain medical equipment, normally a stretcher, is provided with the helicopter. Sometimes radio equipment is installed, but most other medical equipment and supplies must be provided by the hospital. Patients could be billed for the use of expendable supplies in the same manner as if they had been consumed in the hospital.

3. Communications equipment and dispatching services. In order for the service to be effective, the hospital should provide 24-hour dispatching services for the helicopter and sufficient equipment to provide reliable communications with the base hospital and with hospitals where the helicopter might land. Similarly, communications could be established with the state police, KEWS, and other agencies. The University of Kentucky and the University of Louisville and most other hospitals throughout the state already possess the nucleus of the required communications network through the hospital emergency radio system; thus, little additional base station equipment would be required. Helicopter radios and portable radios for the medical personnel would be necessary.

4. Quarters for the helicopter crew. The helicopter pilots would normally sleep at the hospital and would require space for sleeping, as well as a "ready room" for planning of flights and general use.

5. Administrative support in terms of a person or persons assigned to recordkeeping, secretarial tasks, and similar services for the helicopter program, so that efficient data may be retained for billing and planning purposes. Also necessary would be the services of an assistant hospital administrator, probably on a part-time basis, to coordinate the various facets of the program and its scheduling.

6. A suitable helipad within easy walking distance of the entrance of the emergency department. An on-ground pad would be suitable.

7. Insurance for the personnel of the hospital taking part in the operations: life and accident insurance, as well as medical malpractice insurance. Overall insurance covering various other aspects of the program (including the helicopter, particularly if it is a state-owned aircraft).

8. Initial and continuing medical education and training for personnel involved in the program and for personnel at local sending hospitals and ambulance services. Training for outlying hospital and ambulance personnel would deal with requesting helicopter evacuation, helicopter safety precautions and landing advice, preparing the patient for air transport and other similar items. With little difficulty, some of this training could be included in the Emergency Medical Technician training courses supervised by the Department for Human Resources and the Paramedic training courses supervised by the State Board of Medical Licensure.

9. A suitable enclosure with a roof to protect the helicopter from inclement weather and vandalism or other damage. This protection would also

assure its ready accessibility in the event of snow or ice storms.

Where Should the Helicopters be Based?

From the information gathered during the the study it is clear that the only concentrations of hospitals and medical personnel are in Lexington and Louisville. While there are many excellent regional medical centers, they do not possess medical schools, personnel, or other resources in sufficient quantities to provide the medical personnel necessary for 24-hour operation of air ambulance service and may not be able to provide the medical specialties in the hospital on a 24-hour basis. The state's two largest medical facilities and surrounding hospitals do.

In Eastern Kentucky the shortages are especially critical, due to the large number of smaller medical facilities. Ideally, it might seem desirable to station helicopters at locations dispersed throughout the state so that most flights would be one way, thus decreasing the response time and time for transfer to Lexington or Louisville. Unfortunately, the shortage of medical personnel and equipment for the flights, as well as the problems of support and maintenance of helicopters located in smaller cities, makes this idea much less attractive.

If the victims were waiting on the roadside for the arrival of the helicopter there might be more justification for such a program, but since most missions in Kentucky are likely to be inter-hospital transfers, the patient will already be located in a medical facility with its attendant staff and equipment. Thus, the response time for the helicopter will not be detrimental to the patient and the resources of the sending community will not be drained by having to send local medical personnel with the helicopter.

From all of the available information it is clear that the best possible use of medical personnel, aircraft, and maintenance facilities dictates that the helicopters be based physically on the premises of the University Hospital in Louisville and the Albert Chandler Medical Center at the University of Kentucky in Lexington. In these instances trained medical personnel will be available at all hours, Jet A fuel will be available, and the program will be more cost-efficient. Also, billing patients for medical fees along with flight fees should defray the cost of the service to the state and should, as is pointed out later, make the service self-sustaining.

This plan would assume that the MAST programs at Ft. Campbell and Ft. Knox would continue in operation at the present levels, to provide transportation in the far western part of the state, which would not be within the range of most medical evacuation helicopters based in Louisville.

Hospital Helipads

A vital factor in the use of helicopters as aeromedical evacuation vehicles is making use of the helicopter's vertical takeoff capabilities in landing the patient close enough to the hospital emergency room door to assure a smooth and effective transfer from the aircraft to the hospital.

It is difficult enough to find a place to land when picking a victim up from a highway or a forested area, but when the helicopter cannot land at the medical facility the problem of patient care is compounded. At present,

according to the Kentucky Division of Aeronautics, eleven hospitals heliports have been certified and construction of another began in August, 1980.

Helicopters do land at other hospitals in the state, but only through some makeshift and potentially hazardous arrangements. Some institutions clear the parking lot of cars when a helicopter is coming, some have it land on the grass, some in other locations, but nothing has been done in most of these locations to remove overhead wires, light poles, gravel, and other potential causes of inconvenience or disaster. Some landing spots are unusable in bad weather.

The Director of the Division of Aeronautics has said that "In general it is our opinion that a good system of heliports is vital to the effective operation of an air ambulance service," and the Division has, for the past four years, had a program to assist hospitals in the construction of helipads through matching funding. Although the program calls for the establishment of one-hundred helipads in a five-year period, it has so far secured the participation of less than ten hospitals.

At present, our two largest state-operated facilities, University Hospital in Louisville and the University of Kentucky Medical Center in Lexington, do not possess helipads, and helicopters cannot land within convenient distance of the facility, much less the emergency department. Both must rely on ground ambulance transportation from the helicopter to the hospital. An on-ground helipad is presently contemplated for the new hospital now under construction at the University of Louisville.

Two basic options exist for helipads, depending upon space available and such other factors as cost. The on-ground helipad is the least expensive to construct, operate and maintain, provided the land is available. In this pad a paved area with suitable markings and lighting is constructed near the emergency room entrance. All such obstructions as overhead wires are removed from the immediate vicinity and the normal landing and takeoff path of the helicopter. Normally, costs are in the \$5,000 to \$10,000 range, or less, depending upon the surface chosen, amount of paving, lighting, and other features. The rooftop helipad is usually much more expensive, since frequently it is necessary to structurally improve the roof, extend elevators to the roof, and provide fuel spill and firefighting equipment and facilities. Also, according to some physicians interviewed, the combination of the decrease in altitude by the helicopter and the further rapid decrease in altitude from the rooftop to the emergency room (commonly located on the ground floor) is not beneficial to many patients. Moreover, there are problems involved in caring for the patient in the elevator, should his condition worsen. The rooftop helipad does have the advantage that it is normally higher than the obstructions referred to above.

Until the advent of MAST helicopter flights and the neonatal transport operations of the Kentucky National Guard, many hospitals did not see the need to spend precious financial resources on a helipad which might see little use. If a helicopter air ambulance service is inaugurated, it is anticipated that more hospitals will construct helipads.

TABLE 3

Hospitals With Heliports Certified
by Division of Aeronautics

Lourdes Hospital, Paducah
 Crittenden County Hospital, Marion
 Daviess County Hospital, Owensboro
 Warren County Hospital, Bowling Green
 Breckinridge County Hospital, Hardinsburg
 University of Louisville Medical Center, Louisville
 (Planned construction)
 Baptist East Hospital, Louisville
 Saint Elizabeth (South) Hospital, Edgewood
 Saint Luke Hospital, Fort Thomas
 Hopkins County Hospital, Madisonville
 Appalachian Regional Hospital, Whitesburg
 University of Kentucky Medical Center, Lexington (1 mile from Hospital)

How Should Pilots be Trained?

In order to assure quality air operations, as well as quality medical care in the aeromedical evacuation program, it is important that pilots, maintenance, personnel, and aircraft and their maintenance be top notch. There are various ways of assuring such quality in aviators and aircraft. The first and foremost includes operating the entire service under the provisions of Part 135 of the Federal Air Regulations, whether or not the service must meet the requirements legally. Part 135 of the Federal Air Regulations deals with air taxi and charter air carriers, and imposes airline personnel, maintenance, and equipment standards higher than those which must be met by the general aviation community.

Additionally, it is recommended that the medical requirements proposed for Part 135 but never adopted by the government be implemented wherever possible, to assure that proper medical equipment, compatible with aviation use, is on board the aircraft during medical missions.

Discussions with the National Guard and others make it clear that a pilot should possess a commercial rotor wing license and have a minimum of 1,000 flying hours in helicopters, preferably a minimum of 2,000 hours. He should have an instrument flight rating, issued by the Federal Aviation Administration, and should have considerable experience in night flying and mountainous terrain flying. Several commercial operators require 3,000 hours total, with at least 500 hours night flying in helicopters.

The operational experience of air ambulance operations shows that it is unnecessary for the pilot to have medical training or experience, as he will not normally be providing patient care. In the hospital-based system he will only fly the medical personnel to where they are needed in the safest and most efficient manner. If a program is chosen whereby physicians or nurses do not accompany the helicopter on each flight, then training of the flight crews to at least the emergency medical technician, and preferably to the paramedic, level is essential. No patient should be consigned to a helicopter or other aircraft unless he is attended by competent medical personnel. Competent medical personnel should be taken to mean someone besides the pilot, since the

pilot could not provide medical care and fly the aircraft at the same time.

What Medical Training Must be Given and by Whom?

If the mode of operation chosen is a hospital-based service, the medical personnel accompanying the helicopter would normally be physicians or flight nurses. But being a physician or a nurse does not give an automatic understanding of the problems involved in aeromedical evacuation. It is recommended that the guidance provided by FAA Advisory Circular 67-1 (which relates to specific information about medical considerations in aeromedical evacuation) be followed.

Both physicians and nurses are utilized in the Air Force aeromedical evacuation program throughout the world. With the help of the training program curricula and materials developed by the Air Force, and by civilian hospitals with long experience in such programs, an adequate indoctrination and inservice training program can be developed for all medical personnel participating in aeromedical evacuation flights.

Training should be conducted by the sponsoring hospital and should include the aforementioned medical subjects, survival, communications, aircraft familiarization, and related matters. Additionally, the aeromedical evacuation personnel, as well as other hospital personnel, should be utilized to train or assist in the training of personnel at sending hospitals, paramedics, emergency medical technicians, and local physicians.

Training given to local personnel would normally include such subjects as aircraft availability and limitations of the program, communications procedures, requesting the helicopter, stabilizing and packaging the patient for flight, helicopter safety and landing procedures, and recordkeeping.

If a method of operation is chosen where the helicopters are not based at a hospital, or where physicians or nurses are not on board the aircraft, helicopter crew members, other than the pilot, must be trained, at least to the emergency medical technician, or preferably the paramedic, level. In addition they will need the same type of aeromedical and ancillary training a physician or flight nurse gets, adjusted to their level of medical knowledge and training.

CHAPTER IV

EQUIPMENT, COSTS AND FINANCING

What Helicopters or Other Aircraft Should be Used?

Helicopters

At the present time there are three or four helicopter manufacturers producing helicopters suitable for aeromedical evacuation missions. The most commonly used models are produced by Bell Helicopters (Jetranger, Longranger, UH-1 "Huey"), Hughes Helicopters (500 series), the French firm Aerospatiale (AS 350D A-Star and SA 319 Alouette III), and the German combination of firms Messerschmitt-Bolkow-Blohm (MBB 105). All of the helicopters are turbine-powered and will transport two or more patients. A few of the aircraft are powered by two turboshaft engines. Prices range between \$400,000 and \$750,000, depending on the basic equipment and options, with all-weather, medically-equipped machines being in the upper portion of the range.

While all of the manufacturers claim to be able to carry more than one patient, the helicopter size, configuration and stretcher placement do not permit the full range of effective medical treatment for more than one patient. In the Hughes 500 series, for example, the cabin is narrower than the stretcher and special doors with blisters (bubbles) must be fitted to accommodate the stretcher. The patient's head and feet are not very accessible. In the Bell Jetranger and Longranger, patients would normally be placed one above the other, making cardiopulmonary resuscitation difficult. Similar stretcher placement problems exist with all but the very largest helicopters. Cabin size limitations also demand changes in the type and amount of medical equipment and supplies which can be carried on board, but adequate supplies can be carried if careful preplanning has been done.

Purchasers might wish to obtain surplus military helicopters through civil defense channels; such models as the Bell UH-1B (with three-stretcher capacity and jet engine) and the piston-engine Sikorsky H-34 (civilian S-58) are available. The price is normally a nominal transfer fee plus freight from Davis-Monthan Air Force Base in Arizona. Attractive as this solution might seem, the military machines are transferred on an "as-is where-is" basis and are not certified for civilian flight without modifications, which are sometimes extensive. Obtaining parts is sometimes a problem; maintenance costs and operating costs are higher than for most civilian models; and the Federal Aviation Administration and other authorities advise against such procurements.

The major limitations for all helicopters are range and speed. Some Kentucky cities will be beyond the fuel range for some models. Larger helicopters in the size range of the UH-1 series, such as the Bell Models 205 and 212, bear a price approximately twice that of the more commonly used models and, while offering increased cabin space, carrying capacity, and other features, still lack the range and speed even of some of the smaller helicopters. Operating costs for the larger models is extremely high when compared to those for the smaller helicopters.

On a typical flight to a distant point, the helicopter might need to land

and refuel, proceed to destination, pick up the patient, land and refuel, and then proceed to the hospital. Sometimes, as is the current practice on National Guard flights, the medical personnel are delivered to the transferring facility directly and then, while they are stabilizing the infant and preparing it for transport, the helicopter goes to the nearest source of jet fuel and refuels. There are some lesser limits on the utility of helicopters in Kentucky, which have to do with the lack of heliports or helipads at hospitals - including University Hospital (U of L) and UK Medical Center - lack of jet fuel at airports around the state, and communications problems between hospitals and between helicopter and hospital.

A helipad is in the plans for the University of Louisville's expansion and replacement of General Hospital, expected to be completed by 1982. At present, no such plans exist at the University of Kentucky, and the National Guard, in its high-risk infant transportation program, must now land at the practice football field and await the arrival of a ground ambulance. Long waits have not been uncommon, according to National Guard officials. If there is to be a viable helicopter ambulance program in Kentucky, certainly the two larger medical centers in the state should have landing facilities within a short distance of the emergency room, and more hospitals throughout the state should begin installing their own helipads to ensure smooth operation of the anticipated program, or smoother operation of the existing programs offered by the National Guard and MAST units.

Fixed-Wing Aircraft

Fixed-wing aircraft, usually light twin-engine executive type transports of the type manufactured by Beech, Cessna, and Piper, are utilized by some hospital-based services throughout the United States for those flights which are beyond the range of helicopters or where the advantage of the speed outweighs the disadvantages of the airport connections which are necessitated. A typical aircraft of this class, the Cessna 402C, has a maximum speed of 266 miles per hour and a range of 1,420 miles (with forty-five minutes reserve) at a speed of 168 mph at ten thousand feet altitude. Similar aircraft equipped with turboprop engines will make fifty to one hundred miles per hour greater speed. The cost of operation of light twin-engine aircraft is generally considered to be about half of that of a helicopter.

As with helicopters, the aircraft are not normally equipped or designed for use in aeromedical evacuation and thus must be modified by removal of seats and installation of medical equipment. In light twin-engine aircraft it is sometimes very difficult to get a patient into the aircraft, due to the placement of doors and wings. As with the helicopters, these aircraft must be equipped for all-weather flying if they are to be useful in the aeromedical evacuation role.

Single-engine aircraft (other than helicopters) are not normally operated by any of the major air ambulance programs, because they feel that the single-engine aircraft does not provide the necessary margin of safety.

Such jet aircraft as the Learjet are used by very few programs, due to high initial cost and high operating costs, but some programs do have them on standby from existing charter operators. With a maximum speed of 550 mph, an economical cruise of 460 mph, a maximum range of 1,578 miles at an altitude of 49,000 to 51,000 feet, the Learjet 28 is suitable for long-range rapid transportation of sick persons for organ transplant or to specialized, out-of-state medical facilities, but its use would be infrequent.

The Question of Range

Statistics on the range of the various helicopters show that the maximum range for any of the common models is the 430-mile range of the French AS 350D A-Star, with the shortest range being 263 miles for the Hughes 500. While maximum range is an important figure, it can be misleading, since it presupposes a straight line flight from point A to point B. In a normal medical situation, however, the helicopter must warm up, fly from the base to the medical facility, wait on the ground until the patient is loaded, warmup, and then return to the base facility. If all this is to be done safely, with consideration for extra fuel for warmup, hovering, locating of the sending hospital (perhaps in bad weather), for head winds, or other unfavorable weather conditions, and for a margin of safety, the effective "radius of action" of the helicopter is somewhat less than one-half of the maximum range.

The military limits the response of MAST helicopters in most instances to 100 air miles from the base. With the typical Bell Jetranger the maximum range is 360 miles, the Longranger's is 390 miles, the Alouette III's is 360 miles and the Bell Twin 212's (UH-1N) is 296 miles. Cutting these distances in half you get ranges from 148 to 245 miles, with no allowance for the limiting factors shown above. The Army limits the 148-mile radius of the UH-1N to 100 miles, which provides an acceptable safety factor and is about 2/3 of the maximum radius. Thus with a Jetranger or Alouette III the radius of action turns out to be about 120 miles.

The accompanying charts show that, assuming a 100-mile radius of action, flights to portions of eastern and western Kentucky cannot be accomplished without refueling. Even with the approximately 135-mile radius of action necessary to reach the easternmost portion of the state, Paducah and the Jackson Purchase area of the state could not be reached by helicopters stationed in Lexington and Louisville.

However, using the combined resources of the 100-mile radius MAST helicopters and the 100-mile radius helicopters stationed in Lexington and Louisville, all but the easternmost portion of the state would be covered. Using 135-mile radius helicopters in Lexington and Louisville (or 135-mile radius helicopters in Lexington and 100-mile radius helicopters in Louisville), together with the existing MAST units, all portions of the state would be covered.

Flying time to virtually any location within the response area of each helicopter would be approximately one hour.

As can be seen from the charts and the data, the best way to provide reliable coverage to the entire state, particularly to western Kentucky, is for the current MAST programs to remain in existence, for fixed-wing aircraft to be used where the radius of action of state helicopters is exceeded, or for helicopters to refuel at or near the hospital sending the patient for transfer. Another alternative would be to place a third helicopter at a hospital in Western Kentucky, but at present the medical resources found in suitable western Kentucky cities do not equal the combined resources found in Louisville or Lexington.

If the fixed-wing aircraft option is chosen, the victim would have to be transported from the local hospital to a nearby airport for transfer, but given the vast speed advantage of fixed-wing aircraft over a helicopter, and the fixed-wing aircraft's not having to refuel, the total time of the transfer should not exceed that of a helicopter, and may be less.

Figure 1

KENTUCKY AIRPORTS

KENTUCKY AIRPORTS

1976

Compiled by

KENTUCKY DEPARTMENT OF

TRANSPORTATION

Franklin, Kentucky

LEGEND

SCHEDULED AIRLINES

PAVED - LIGHTED

PAVED - UNLIGHTED

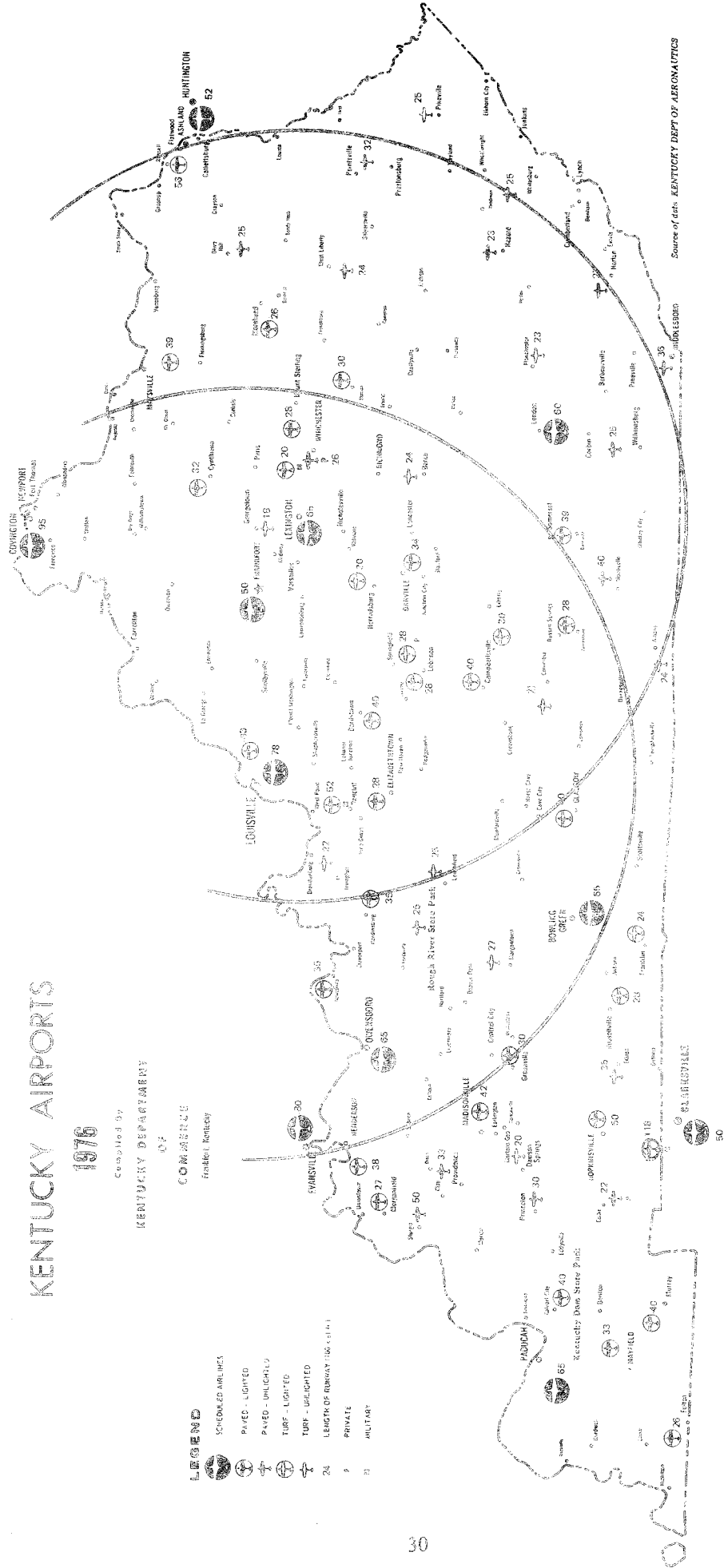
TURF - LIGHTED

TURF - UNLIGHTED

LENGTH OF RUNWAY (feet)

PRIVATE

MILITARY

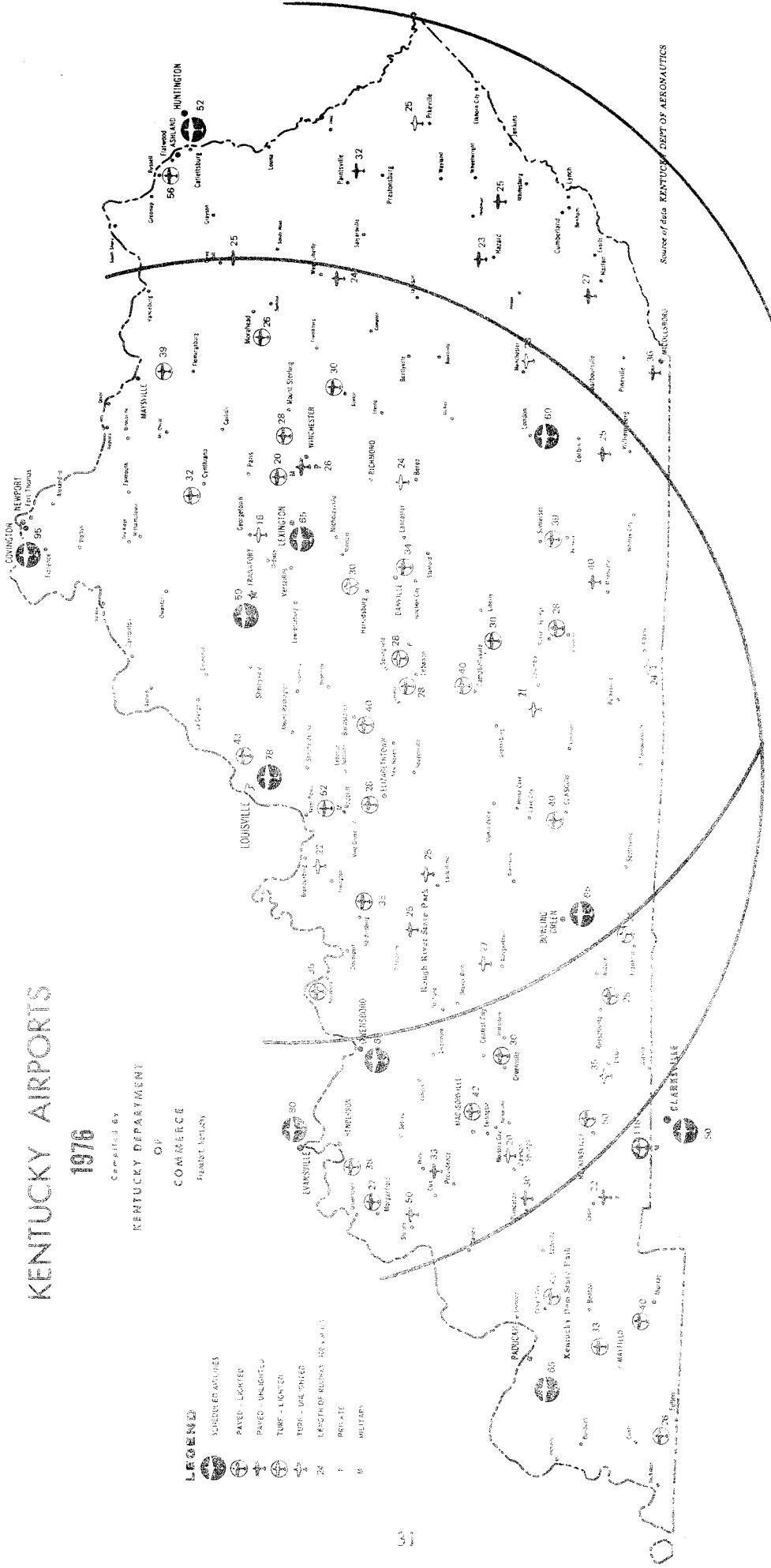


Source of data: KENTUCKY DEPT. OF AERONAUTICS

COVERAGE FROM 100 MILE RADIUS OF ACTION
HELICOPTERS STATIONED IN LEXINGTON AND
LOUISVILLE

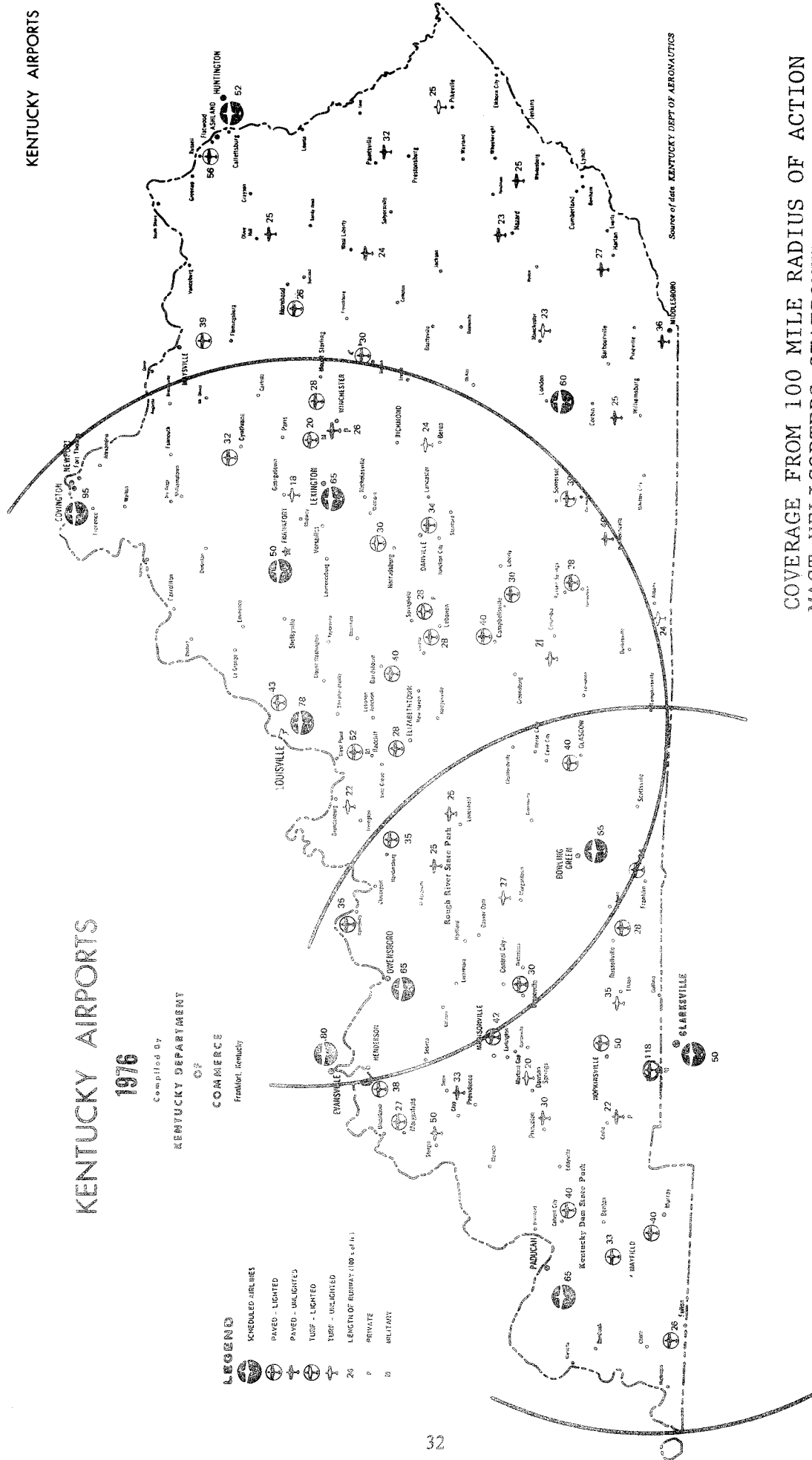
Figure 2

KENTUCKY AIRPORTS



COVERAGE FROM 135 MILE RADIUS OF ACTION
HELICOPTERS STATIONED IN LEXINGTON AND
LOUISVILLE

Figure 3



COVERAGE FROM 100 MILE RADIUS OF ACTION
MAST HELICOPTERS STATIONED AT FT. KNOX
AND FT. CAMPBELL

Figure 4

KENTUCKY AIRPORTS

KENTUCKY AIRPORTS

1976

Compiled by
KENTUCKY DEPARTMENT
OF
COMMERCE

Frankfort, Kentucky

LEGEND

SCHEDULED AIRLINES

PAVED - LIGHTED

PAVED - UNLIGHTED

TURF - LIGHTED

TURF - UNLIGHTED

LENGTH OF RUNWAY (in feet)

PRIVATE

MILITARY

81

81

81

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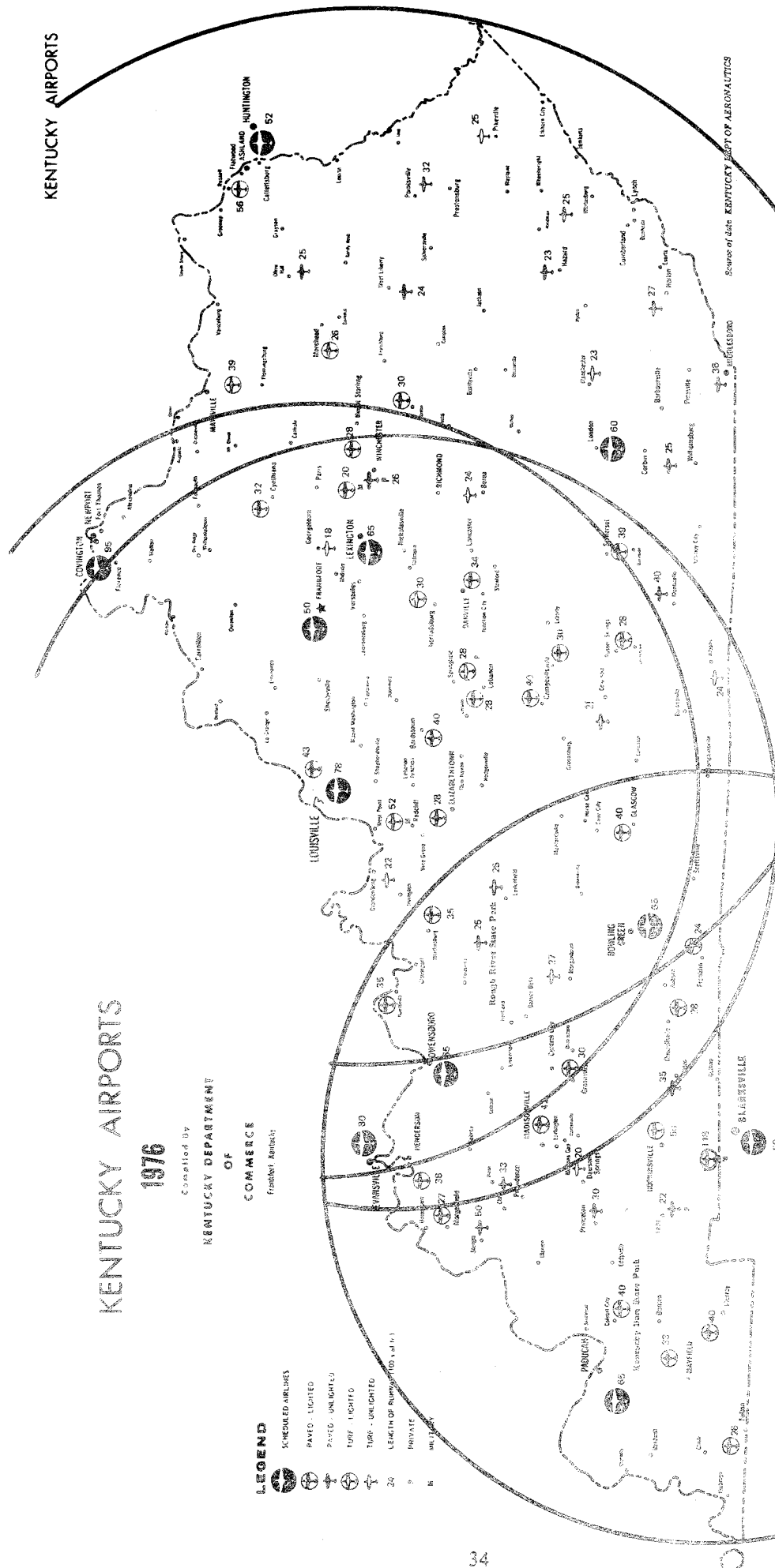
81

COVERAGE FROM 100 MILE RADIUS OF ACTION
HELICOPTERS STATIONED IN LEXINGTON AND
LOUISVILLE COMBINED WITH MAST HELICOPTERS
STATIONED AT FT. KNOX AND FT. CAMPBELL

Source of data: KENTUCKY DEPT OF AERONAUTICS

0101120000

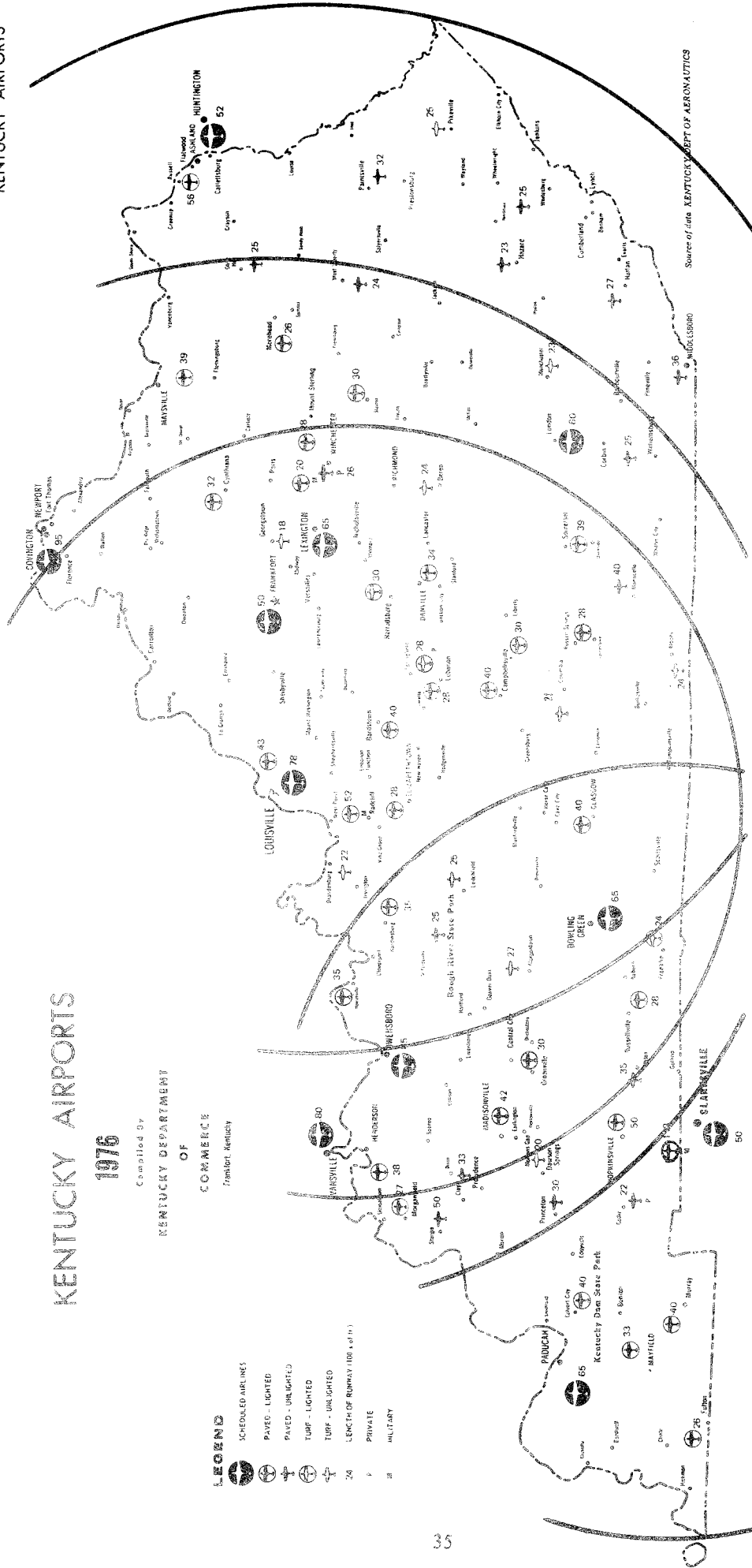
Figure 5



COVERAGE FROM 135 MILE RADIUS OF ACTION
HELICOPTER STATIONED IN LEXINGTON, 100
MILE RADIUS OF ACTION HELICOPTER STATIONED
IN LOUISVILLE, COMBINED WITH MAST HELICOP-
TERS STATIONED AT FT. KNOX AND FT. CAMPBELL

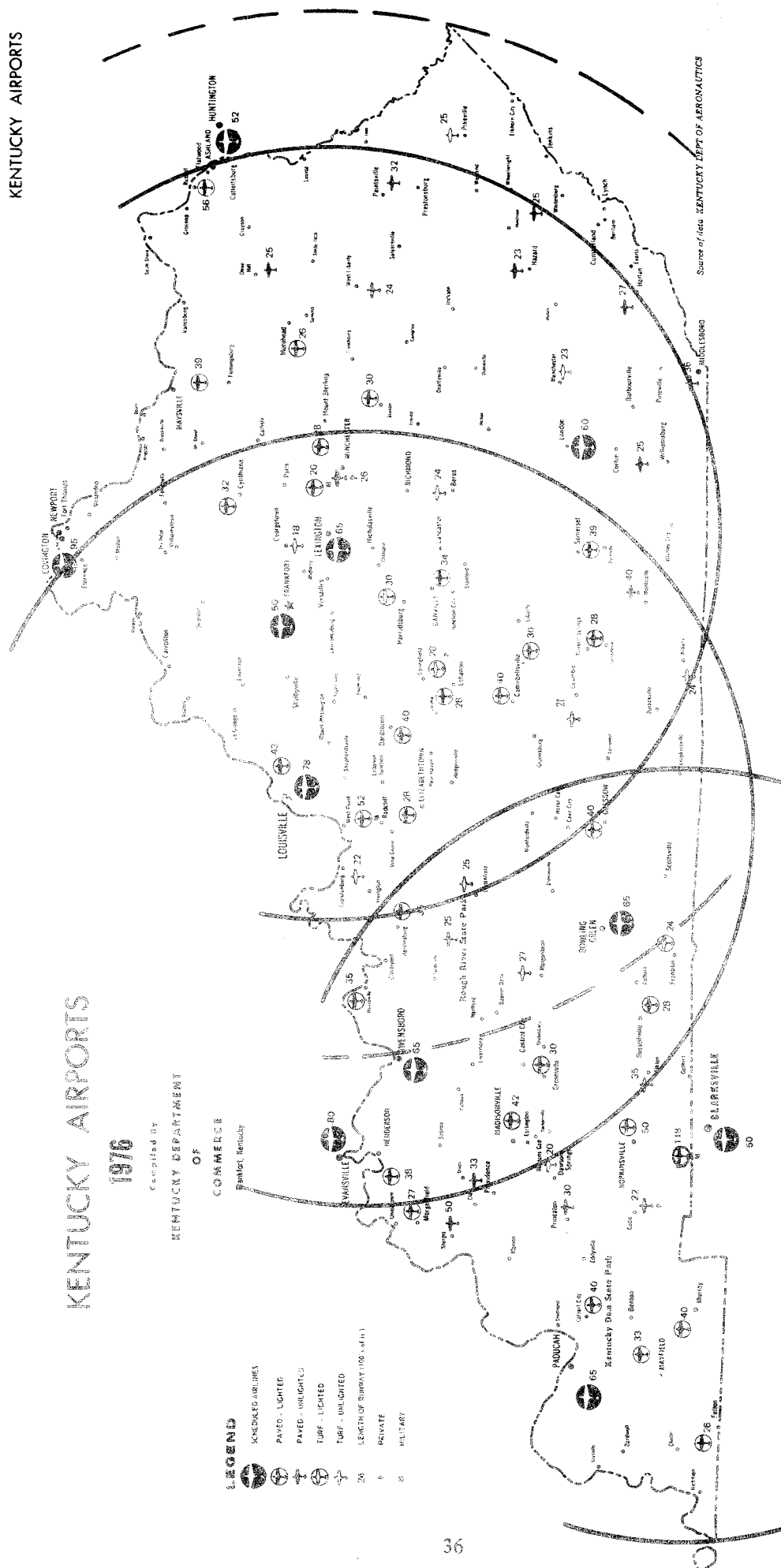
Figure 6

KENTUCKY AIRPORTS



COVERAGE FROM 135 MILE RADIUS OF ACTION
 HELICOPTERS STATIONED IN LEXINGTON AND
 LOUISVILLE COMBINED WITH MAIST HELICOPTERS
 STATIONED AT FT. KNOX AND FT. CAMPBELL

KENTUCKY AIRPORTS



COVERAGE BY 100 MILE RADIUS OF ACTION
(SOLID LINE) AND 135 MILE RADIUS OF
ACTION (BROKEN LINE) HELICOPTER STATIONED
IN LEXINGTON COMBINED WITH RADIUS OF
ACTION OF MAJ HELICOPTERS STATIONED
AT FT. KNOX AND FT. CAMPBELL AS PROPOSED
BY KENTUCKY STATE POLICE

Recommendations

During the initial phase of any air ambulance program in Kentucky, helicopters should be the main vehicle for use within a 100 to 150-mile radius of action. Helicopters purchased or leased for this program should have a radius of action of approximately 150 miles or more. They should be jet-powered, perhaps with twin engines (especially if larger models are chosen), equipped for instrument flight, and suitably equipped with medical and communications equipment. They should have a cruising speed in excess of 100 mph.

Consideration should be given to a lease arrangement for the operation of light twin-engine aircraft, on an as-needed basis, for flights beyond the range of the helicopter or where the helicopter is not the vehicle of choice, due to speed, weather, or medical considerations. This aircraft, too, must have the instrument flying capability.

If the major medical centers in Louisville or Lexington do not establish facilities for the landing of helicopters within close walking distance of the emergency department entrance, consideration should be given to the use of light twin-engine aircraft until such time as helipads become available. Ambulances should be available at all times.

All hospitals in the state which have not already done so should install helipads, preferably on ground level, as near to the emergency department entrance as possible, and remove such nearby obstructions as lights, wires, and trees, so that the approach of the helicopter is made less hazardous.

How Should the Helicopters or Aircraft be Equipped?

Aeronautical equipment on board the helicopter or aircraft is, in large measure, specified by federal regulations. Part 135 of the Federal Aviation Regulations specifies in detail equipment which must be on aircraft operated by air taxi operators and commercial operators. Examples of required equipment are dual controls, altimeters, carburetor heating or de-icing equipment, fire extinguishers, oxygen equipment, instrument flight equipment for night flights and bad weather flights and radio and navigation equipment. This equipment normally comes with the purchased or leased aircraft. If it is leased it is the responsibility of the lease operator to maintain the aircraft and its equipment.

Medical equipment is another matter. At present there is no federal requirement covering medical equipment for air ambulance aircraft. Proposed regulations issued in 1977 were never adopted. Existing state regulations (902 KAR 20:115) were designed for ground ambulances. In lieu of regulations, the recommendations of Federal Administration Advisory Circular 67-1, the proposed regulations themselves, and equipment carried by the St. Anthony's Hospitals in Denver, Colorado, can serve as meaningful guidelines.

A helicopter has space and weight constraints which do not apply to the normal ground ambulance, so selection of equipment meeting the medical needs of the patient and the limitations of the aircraft, as suggested in the abovementioned documents, is essential. It is necessary to heed the advice in the advisory circular with regard to equipment and such medical items as

intravenous solutions, which may be affected by changes in altitude; weight-operated traction devices, and other equipment which could be damaged or destroyed by vibration, or injure the patient because of vibration, or by a hard landing; and equipment which could interfere with the aircraft's navigation or communication systems. The U.S. Air Force has a listing of medical equipment which has been tested and approved for use on military aircraft, with due consideration being given to the factors which may render the equipment unsuitable for aircraft use.

Helicopter Leasing

An alternative to purchasing the helicopter is a lease arrangement. Under the normal lease arrangement the lessor provides the helicopter, pilots, maintenance personnel, parts, and program implementation consultations. Most leases are executed on a year-to-year basis.

The three largest medical helicopter leasing firms are Airwest Helicopters, Inc., of Ft. Collins, Colorado; Evergreen Helicopters, Inc., of McMinnville, Oregon; and Rocky Mountain Helicopters, Inc., of Denver, Colorado. All offer about the same types of leasing arrangements.

In any leasing arrangement the operator should be reliable and should have a good track record in the helicopter operations business, preferably in the aeromedical evacuation business. The firm should be large enough to be able to supply a backup aircraft in the event the primary aircraft is destroyed, damaged, or out of service for maintenance.

Leasing can be done on several bases, such as leasing aircraft and pilot and maintenance, leasing aircraft and maintenance, or time-sharing leasing of the aircraft, but the most satisfactory program involves the lessor's providing an aircraft, pilots, and maintenance specifically for the air ambulance program and for no other purposes. Fixed-wing aircraft are frequently leased on an as-needed basis for occasional long-range flights, when it is unnecessary to have the aircraft on 24-hour standby. For the occasional flight it has normally been found acceptable to charter a suitably equipped aircraft from an air charter service.

The amount of the lease varies with the aircraft chosen. Typical is Rocky Mountain Helicopters' charges for the following:

	<u>A Star 350</u>	<u>Longranger II</u>	<u>Alouette II</u>	<u>BO-105CBS</u>
Per month	\$22,000	\$23,000	\$24,000	\$35,000
Per flight hour	\$200	\$220	\$240	\$350

All fuel is paid for by the Hospital.

Fuel can be a substantial additional cost, since a Bell Longranger uses 35 gph, Aerospatiale A-Star 350 uses 36 gph, the Aerospatiale Alouette III 316B uses 60 gph, the Aerospatiale Alouette III 319B, 55 gph, and the Bell UH-1 uses 80 gph. As of January 1, 1981, Jet A fuel prices were in the \$1.50 to \$1.55 per gallon range.

STANDARD CONTRACT PROVISIONS

HELICOPTER LEASE

(Rocky Mountain Helicopter, Inc.)

MINIMUM CONTRACT PERIOD:

One year.

CONTRACT RATE:

\$31,000 to \$36,000 per month, depending on helicopter model, number of patients transported and geographic area served.

ROCKY MOUNTAIN HELICOPTERS WILL PROVIDE:

Two pilots
One mechanic
All maintenance
Insurance
Program implementation consulting

HOSPITAL WILL PROVIDE:

Helipad
Communications center
Medical personnel
Medical equipment and supplies
Crew accommodations
Reimbursement for jet fuel (cost of which is included in contract rate above)

Details and firm prices will be set forth in a formal written proposal available upon request following the initial site visit by RMH personnel.

State Ownership Vs. Leasing

The questions of state ownership vs. leasing of aircraft and state operation vs. contracting with pilots involve several factors. Most of these factors of the air ambulance program have to do with anticipated longevity.

Currently the Department of Finance operates and maintains three helicopters, one Bell Jetranger, one Bell Longranger, and one Sikorsky S-76. Both Bell helicopters are equipped with stretcher kits for aeromedical evacuation, but are not used for those purposes. Primary uses for the entire fleet are executive transportation, strip mine enforcement, and transportation of business prospects.

Typical studies of leasing vs. state ownership and operation, such as that recently conducted by the State of Missouri, show that state operation and ownership is the least expensive option in the long run. This conclusion would assume the long-term operation of the program.

State ownership and operation would certainly be feasible if the State Police were to provide the service, especially since the pilot salaries would not be an extra cost item. The State Police already have several qualified pilots.

Operation by the Department of Finance would be another possibility, but would require stationing of pilots on a 24-hour-per-day basis at one or more central locations, presumably at the University of Louisville and the University of Kentucky, and would require additional personnel. Maintenance of a routine nature could be provided at the Department's facility in Frankfort.

Leasing a single helicopter has been estimated by Rocky Mountain Aviation of Denver and Evergreen Helicopters of Oregon to be in the \$450,000 per year range for the helicopter, pilot, and maintenance. Nearly all of the hospital-based programs in the country operate their helicopters on a lease arrangement. The amount of the lease varies, depending upon the aircraft chosen, the hours flown, and similar factors. Leasing would be an attractive option, at least initially, if it is uncertain how long the program will continue, if maintenance or backup aircraft may be problems, or if the state does not choose to make a capital investment in aircraft. In the lease option the higher overall costs can be offset by not having to make a large capital investment in aircraft, spare parts, and the hiring of additional pilots, as well as by the convenience of being able to drop the program readily, should the financial burden become excessive.

Who Should Maintain the Helicopters?

Depending on the operational options chosen maintenance of the helicopters varies. If a leasing arrangement is chosen, maintenance is normally the responsibility of the lease operator. In any leasing arrangement the contract should specify maintenance responsibility and provisions for having another helicopter available within a specified number of hours, if the original aircraft is out of service for any cause or is expected to be out of service for an agreed upon minimum time.

If the helicopters are to be purchased, maintenance could be handled by

the Department of Finance at their existing facility in Frankfort. This option might entail the employment of additional maintenance personnel. If this option were not possible (particularly in a given emergency situation), a commercial helicopter repair station could be utilized.

In either event a sufficient stock of spare parts should be kept on hand for routine maintenance. Otherwise, even routine maintenance may result in enough downtime to hurt the program.

Table 4

Locations At Which Jet A Fuel Is Available

Somerset	Henderson
Paintsville	Hazard
Paducah	Glasgow
Owensboro	Frankfort
Madisonville	Maysville
Louisville	Greater Cincinnati Airport
London	Campbellsville
Lexington	Bowling Green
Kentucky Dam	Ashland

SOURCE: Kentucky Airport Directory

The Fuel Problem

One problem in the operation of a helicopter-oriented air ambulance program is the availability of suitable fuel. All of the helicopters currently used for aeromedical evacuation have turboshaft (jet) engines requiring a fuel known as Jet A. While this fuel is readily available at larger airports throughout the state, many of the smaller airports do not have it and it may be difficult for them to acquire additional fuel storage capacity for handling it.

Since many of the sites to which an air ambulance will be making large numbers of flights are nearly outside the maximum radius of action of the helicopter, it will be necessary to refuel for flights beyond that radius. Refueling is not an extremely serious problem if fuel is readily available. The accompanying chart shows, however, that it isn't always available. The aircraft must then divert to a location which has the fuel, thus increasing response time and operating cost.

It might be possible to establish fuel trailers at the locations to which the largest number of long-range flights are contemplated and then have the pilot refuel the aircraft at those locations. Where possible, such fuel supplies should be located at a hospital, so that refueling can be done while the patient is being prepared for loading onto the helicopter.

Another problem, if much night flying is anticipated, is whether fuel is available at smaller airports on a round-the-clock basis. If it is not, then aircraft will either have to divert to another location for fuel or attempt to

make arrangements with the fuel supplier before the flight or while en route, so that refueling after normal business hours is possible.

As more jet-powered helicopters are introduced into the civilian helicopter inventory in Kentucky, and as more civilian jet aircraft are acquired, the availability of jet fuel should increase, but it is impossible to predict at what rate this might occur.

How Would Such a Program be Financed?

Present air ambulance programs are financed through several means. The MAST programs are funded through the training and flying budgets of the military units involved, with donations of money and equipment from civilian sources and from state and local governments. State police operated services are normally 100% state funded (initial programs had heavy federal funding, but this assistance has now, for the most part, expired) and no charges are made to the victims for the helicopter or medical services provided. Hospital-based programs generally have a lift-off fee and a mileage charge to all patients transported. In some states this charge is recoverable from third party payors. In nearly all instances the cost of the air ambulance service is not fully reimbursed by this charge. The actual costs of the service are borne by the revenues generated by the patients being treated in the hospital. A typical air-transported patient is in a more serious medical state than a ground-transported patient. His hospital stay is longer, and he needs more specialized care, treatment, and tests. Thus, the hospital is able to generate more revenue from such a patient.

If a hospital would otherwise have unused beds and treatment facilities and most of the patients brought in are revenue patients, the "profits" from the medical treatment of patients offset the cost of operation of the air ambulance service. The helicopter then becomes the means of bringing more revenue to the hospital than the costs of its operation. Apparently, this is the case, since of those hospitals recently initiating such programs, none has discontinued its program.

Theoretically, assuming a sufficient number of paying patients, the same type of program is feasible in Kentucky. However, Kentucky has a distinction that might have substantial impact on such a program here. Both the University of Kentucky and University of Louisville medical centers are state-operated and thus receive a substantial number of non-revenue (indigent) patients. Even though these hospitals do charge for their services, if they were to receive a high proportion of non-revenue patients by air ambulance, the bulk of the expense of transportation and subsequent medical treatment would ultimately be borne by the state. This circumstance could increase the cost to the state of not only the air ambulance service but of medical care at these institutions. There is no way to predict whether the number of non-revenue patients, with the advent of an air ambulance service, would increase, decrease, or remain the same.

Unfortunately, with tight budgeting, both the University of Kentucky Medical Center and University Hospital at Louisville would be hard put to come up with the money either to purchase helicopters or to pay for pilots, maintenance, and fuel for such aircraft, or make lease payments. Given these conditions, it would be necessary for the state, through legislative appropriation, to initially fund the operation. The level proposed would be \$500,000 for

each institution for the first year of the biennium, or \$1,000,000, and a lesser amount, perhaps half or one-third the original amount, during the second year of the biennium. This support would permit the participating universities either to lease an aircraft and pilot or purchase an aircraft. Moneys could also be used for heliport construction, pilot salaries, or other operational costs associated directly with the service. Revenues derived from the operation of the service would be retained by the hospital, with the understanding that they would be used to continue the operation of the service after the period of initial funding had expired. Special legislative funding of the program should not be undertaken past the biennium, nor should any significant amount of general fund moneys be expended on the program after the first biennium, either through special appropriation or otherwise, as the program should be self-sustaining after that period.

If the program is not self-sustaining after the initial period of funding, it should be continued only after reevaluation of the costs and reimbursement potential by the General Assembly, as the continuing costs of sustaining the program may exceed \$1,000,000 per year. If the program is to succeed at all it should be able to stand on its own and not require a supplement from the state. If a supplement is needed, consideration should be given to a multiple-use arrangement, such as operation by the state police, whereby the helicopter could be flown for police purposes when not in use for aeromedical evacuations. In this manner the cost of operation could be shared among several programs.

One other factor which is very important to consider is reassessment of revenues when patients are transported by helicopter from an outlying hospital to a hospital other than the University of Kentucky or University of Louisville. If only lift-off and mileage fees are charged, the cost of operation may not be fully paid and the receiving hospital will reap the benefits of the paying patient without bearing any of the cost of maintaining the air ambulance operation. When patients are transported to hospitals other than the base hospital, arrangements should be made for proper reimbursement of the base hospitals for helicopter operations cost, or for a more equitable sharing of the nonrevenue patients, so that the cost-benefit ratio is more stable and unjust enrichment is prevented.

As far as other funding sources are concerned, it appears that there is no federal money presently available for funding of air ambulance operations; all funds would have to come from the state, then, or from charges made for service or for subsequent medical care. In terms of available state moneys, those funds currently used to pay the National Guard and Kentucky Flying Service for neonatal transportation could be utilized to supplement other state funding sources.

If the program were to be operated by the State Police without charging for transportation or subsequent medical care, the costs would be as estimated by the State Police in their proposal.

Appended to this report are estimates of operational costs as shown in a Rocky Mountain Helicopters promotional brochure and in "Needs Assessment and Feasibility Study of Air Ambulance Service in Missouri," conducted by the Department of Economics of the University of Missouri-St. Louis in September of 1978.

Cost estimates on the operation of helicopters vary widely, depending upon the source of the information and the variables placed in the estimates;

however, it is clear that \$500,000 would permit a hospital to either lease or purchase a basic helicopter. The ultimate decision as to whether to purchase or to lease an aircraft should be left to the administration of the university involved. If a helicopter program should not succeed, then either the lease could be terminated or the helicopter sold. Discussions with the State Police and the Department of Finance, as well as leasing firms, point out that the cost of a used helicopter is not appreciably less than that of a new model. Thus, if the hospital were to sell the helicopter or to transfer it to another state agency, not very much money would be lost in the transaction.

Even if the program were to be operated by the State Police and no charges were to be made to the victims for transportation (which might, incidentally, encourage unnecessary use), additional revenues should be generated for the receiving hospitals. Arrangements should be made, in those cases, to recover a portion of the operating costs for the air ambulance service from the hospitals.

CHAPTER V

RECOMMENDATIONS

1. Air ambulance service for Kentucky appears to have the potential for being self-sustaining, in terms of the numbers of patients who may be air-transportable if a hospital-based helicopter operation is chosen. This potential is reduced if a substantial number of the patients transported are indigent and the state must pick up the bill, not only for the transportation but for the ensuing medical care.

2. Regardless of the options chosen, it is desirable for the current Military Assistance to Safety and Traffic (MAST) programs to continue at Ft. Knox and Ft. Campbell and, where possible, for state financial and equipment support to continue to these programs. Through these means portions of Western Kentucky can have services which the state could not economically provide from Louisville or Lexington.

3. The medical focus of the program should be centered in University Hospital in Louisville and Albert Chandler Medical Center in Lexington. No adequate program can be undertaken without the full medical support these institutions can provide. Arrangements must be made at each hospital for quartering of pilots and for a helipad for the landing of helicopters.

4. Hospitals throughout the state which have not already done so should be encouraged to install helipads to facilitate the implementation of an effective air ambulance program.

5. Initially, it might be better to have a hospital-based air ambulance program, using leased helicopters and pilots, so that if the program is not financially successful, it could easily be dropped at the end of a year or two. The hospital-based program would be better able to recover and balance the costs of operation of the air ambulance program through charges made to the patient, and thus reduce and, within a short period of time, eliminate the necessity of state funding of the air ambulance operation.

6. To accommodate the needs of the state police (as shown in the KSP proposal, Appendix 10) and the medical needs of Eastern Kentucky, it would appear that two helicopters would be needed. The program could be workable if one helicopter were at all times stationed at the hospital, with its crew, with the second being available for police use. Savings can be realized from multiple use of the helicopter, but in order to provide adequate medical coverage, a 24-hour-per-day, 7-day-per-week operation is essential. Some of the costs of operation could be defrayed by making charges to the patient for transportation or by a cost-sharing arrangement, with the hospital returning some of the revenue from the air-transported patients.

7. The state-operated helicopter or air ambulance service should not be subject to the provisions of KRS Chapter 216B, relating to certificates of need and licensure, or to 902 KAR 20:115, relating to ambulance operations, but should be operated in conformity with Part 135 of the Federal Aviation Regulations and, as far as possible, with the provisions of the proposed medical portions of Part 135.

8. In order to ensure that air ambulance service does not become a financial burden to the Commonwealth, initial funding to the Universities for air ambulance costs should not exceed \$500,000 to \$600,000 for each university for the first year of operation, and not more than one-third to one-half of that figure during the second year of operation. No funding should be provided thereafter. During the period of state funding, detailed cost, revenue, and financial and medical data should be provided to the Department of Finance and to the Legislative Research Commission, so that the progress of the program can be closely monitored.

9. The air ambulance service should have no geographic limitations regarding where patients may be boarded or discharged, whether in-state or out-of-state, provided that out-of-state flights do not reduce the capability of providing medical care for the state. In any program, occasional out-of-state flights to such areas as Cincinnati, Evansville, or Nashville are medically necessary for the patient. The air ambulance programs in Lexington and Louisville should operate primarily within the service areas of their respective hospitals but should be permitted to go anywhere in the state when they are needed, at any time, without restriction. Both services should back each other up in times of emergency or aircraft unavailability and should, as far as possible, have programs which are compatible with each other.

10. No flight should be made without a physician or flight nurse on board, unless the purpose of the flight is pilot training. The base hospital should be responsible for the initial and refresher training of all medical personnel in the air ambulance program and should monitor the progress of the program. Additionally, the base hospital should provide all medical equipment and supplies that are not a part of the lease agreement and crew space for the helicopter pilots and maintenance personnel.

11. Operation by the National Guard or by state agencies other than the State Police is not recommended. Operation by the National Guard may violate Army regulations. Operation by agencies other than the State Police would cause tremendous communications and alerting problems and greatly increase the cost of operation.

12. The air ambulance service should respect traditional medical referral patterns and the wishes of the sending physician regarding which hospital a patient will be taken to. However, in the event the patient is not taken to the base hospital of the helicopter, arrangements should be made with the receiving hospital to reimburse that part of the cost of operation of the air ambulance service not covered by charges to the patient.

13. Pilots chosen for the air ambulance operation should have a minimum of two thousand hours of rotor wing time, with at least five hundred of those hours being night flying, regardless of whether they are hired directly by the hospital or are provided by a leasing firm.

14. If within two years the air ambulance program cannot become self-sustaining, a reevaluation should be made to determine whether it should continue. If it cannot be made self-sustaining, the operation should be dropped until such time as conditions indicate that it should be reinstituted. Costs in excess of \$1 million per year to the state are not justifiable if they are not recoverable in some form. The backbone of medical transportation in the state is, and will continue to be, the ground ambulance; enthusiasm for an air ambulance operation should not be allowed to detract from this service.



GENERAL ASSEMBLY

COMMONWEALTH OF KENTUCKY

REGULAR SESSION 1980

Senate Resolution No. 8

January 18, 1980

**The following bill was reported to the House from the Senate and ordered
to be printed.**

A JOINT RESOLUTION requiring a study of the feasibility of helicopter ambulance service.

WHEREAS, Kentucky has many mountainous and rural areas as well as urban; and

WHEREAS, major trauma centers are located only in Louisville and Lexington; and

WHEREAS, ground ambulances may take six to seven hours to transfer injured or sick Kentuckians from their homes or work to a trauma center or specialist at a large hospital; and

WHEREAS, helicopter ambulance service has proved effective in the military role in reducing deaths and improving medical care; and

WHEREAS, many states are now making efficient and cost effective use of helicopters for emergency medical transportation; and

WHEREAS, this system may, if implemented, save the lives of countless Kentuckians;

NOW, THEREFORE,

Be it resolved by the General Assembly of the Commonwealth of Kentucky:

- 1 Section 1. The legislative research commission, in
- 2 cooperation with the departments of human resources,
- 3 transportation, military affairs, and natural resources

1 and environmental protection shall conduct a study of the
2 feasibility of helicopter ambulance service in Kentucky
3 and report on the following:

- 4 (1) Is helicopter ambulance service feasible?
- 5 (2) Who should operate it?
- 6 (3) Where should helicopters be based?
- 7 (4) What helicopters or other aircraft should be
8 used?
- 9 (5) How should helicopters be equipped?
- 10 (6) Who should maintain the helicopters?
- 11 (7) How should pilots and crews be trained?
- 12 (8) Who should regulate the service?
- 13 (9) What costs are involved?
- 14 (10) What medical training must be given and by
15 whom?
- 16 (11) What other factors and recommendations should
17 be considered?

18 Section 2. This report shall be submitted to the
19 Interim Joint Committee on Health and Welfare no later
20 than June 1, 1981.

21 Section 3. Staff services to be utilized in
22 completing this study are estimated to cost \$12,000.
23 These staff services shall be provided from the regular
24 Commission budget and are subject to the limitations and
25 other research responsibilities of the Commission.

Appendix 2
from
NEEDS ASSESSMENT AND FEASIBILITY STUDY
OF AIR AMBULANCE SERVICE
IN MISSOURI

by
Mae Gordon, Ph.D.,
and
Robert Sorensen, Ph.D.,

University of Missouri - St. Louis

September, 1978

IX. The Cost of Helicopter Ambulance Service for Missouri

In this chapter we examine and estimate what it would cost the State of Missouri to provide a helicopter type air ambulance service. Three different models are considered. These include: (1) direct ownership and operation by a State agency; (2) operation by a State agency, but leasing of necessary equipment and personnel; and (3) a State subsidy program to induce private hospitals to initiate the service.

Direct Ownership

Under a direct ownership approach the State would take the entire responsibility for the development and operation of the helicopter ambulance system. The State would thus, purchase the necessary equipment, be responsible for the maintenance of the vehicles purchased, and hire the necessary crew. Since this has been the system of choice for a number of other states (e.g. Maryland and Illinois), and cost estimates rely heavily upon the experience of these states.

The first cost to be considered is the acquisition cost of the helicopters. For this exercise we assume that the vehicle to be acquired is the Bell 206L-1 Long Ranger. Although a number of different helicopter models are currently available, our discussions with officials involved with the operation of other air ambulance services strongly suggested that the characteristics of the Bell helicopter in terms of size, speed, range, and maneuverability make it the vehicle of choice for air ambulance service.

Table IX indicates what the acquisition cost would be for an appropriately equipped Bell 206L-1 helicopter. While the base price for the helicopter is only \$362,000, the addition of necessary optional equipment brings the total purchase price to \$518,700 per helicopter. The prices shown in Table IX are either taken directly from the official price list of Bell Helicopter Company, or estimated from data for other state operated

TABLE IX
Initial Outlay for
Bell 206L-1

Base price ^a	\$362,000
Sound Proof Blanket ^a	1,100
Dual Controls ^a	2,400
Instrument Group ^a	4,550
Heater ^a	7,150
Litter Installation ^a	2,650
Intake Baffle ^a	650
Rotor Brake ^a	3,200
Communication Equipment ^b	10,000
<u>IFR Equipment^c</u>	<u>125,000</u>
TOTAL CAPITAL COST	\$518,700

(a) based upon Bell Helicopter price list

(b) assumes full frequency VHF and 8 channel UHF medical and 2 channel UHF dispatch

(c) The 206L-1 is not currently FAA certified for IFR flying. Certification is expected in January 1979. The price shown is thus an estimated one.

helicopter ambulance services. The most costly piece of optional equipment is the Instrument Flying Regulation (IFR) capability, which adds an estimated \$125,000 to the price of the helicopter.¹ There are three primary advantages to equipping the helicopter with IFR capability.² First, the IFR system allows the helicopter to fly in a variety of weather conditions in which it otherwise could not. Second, it improves the safety of night flying. Finally, it provides for a smoother ride which reduces the possibility of aggravating the injuries of patients on board. Illinois has recently equipped its helicopters with IFR capabilities and the director of flight operations for the Illinois system (Dwayne Moore) has estimated that this has increased the system's potential for pick ups by some 20 percent. Since it is imperative that an air ambulance service be capable of flying as often as necessary, and as safely as possible, the IFR option, even though expensive, was included in the helicopter package.

Once the decision to purchase the helicopters has been made, it is possible to estimate the annualized cost for the operation of the helicopters. Table X depicts the various cost of owning and operating a single helicopter. These costs are based upon a system which operates 24 hours per day, 7 days a week, and is capable of both on site pick up and inter-hospital transfer of patients.

The costs are broken down into two components. Readiness cost represent those cost that must be incurred in order that the helicopter be prepared to operate. Since these cost will be incurred whether or not the helicopter flies, they are considered fixed cost over a budget time period. This cost which amounts to \$161,170 per year includes the amortization of the helicopter, the salaries and fringes for two pilots and three paramedics, and the charges for liability and hull insurance for the aircraft.

1. The optional equipment is priced as if it would be purchased from Bell. Much of this equipment is available which is less expensive and of better

The second group of costs consist of the helicopter operating expenses. These include the cost of fuel, maintenance, and various allowances for helicopter parts and repairs. Following standard practice in the helicopter industry these costs are expressed in terms of dollars per flight hour. Since the helicopter operating cost depend upon the number of flight hours made by the helicopter, these are the variable cost of the helicopter operation.

Since the operating cost of the helicopter varies depending upon utilization, the total cost per year of the helicopter will vary with respect to the annual number of flight hours. Table XI depicts the estimated cost of operating the helicopter under differing assumptions about the annual number of flight hours. As can be seen from Table XI the total cost of the helicopter varies directly with the number of flight hours. Average cost per flight hour, however, varies inversely with the number of flight hours. The decline in average cost per hour as flight hours increase is simply due to the spreading of fixed cost over a larger number of hours of utilization. For a typical utilization rate of 600 hours per year (roughly two flights per day) the helicopter charges amount to \$204,532 per year or an average cost of \$340 per flight hour of operation.

Thus far we have discussed the cost to the State of acquiring and operating a helicopter. These costs, however, do not constitute the total cost to the State of operating the system. In addition to the helicopter cost, allowance must be made for administrative personnel, radio dispatchers, interest charges, overhead expenses and possibly additional communications equipment and helipad construction. Some of these cost, however, might be

quality from alternative vendors. If the air ambulance program is implemented optional equipment from alternative suppliers should be investigated.

2. IFR helicopters may also receive lower insurance premiums.

TABLE X

Fixed and Variable Helicopter Cost per Site

I. Readiness Cost (fixed)

Helicopter Amortization ^a	\$51,870
Pilots (2) ^b	46,000
Paramedics (3) ^c	48,300
Insured ^d	<u>15,000</u>
TOTAL FIXED	\$161,170

II. Direct Helicopter Operating Cost^e

Fuel	\$19.60/hr.
Maintenance	9.40/hr.
Allowance for airframe	22.60/hr.
Allowance for engine	2.20/hr.
Allowance for overhaul	<u>18.47/hr.</u>
TOTAL DIRECT	\$72.27/hr.

(a) amortized over 7 years with 30% residual

(b) salary of \$20,000 per year + 15% fringe

(c) salary of \$14,000 per year + 15% fringe

(d) including liability and hull insurance

(e) estimates from Bell Helicopter Company

TABLE XI

Estimated Annual Helicopter Cost Per Site

YEARLY FLIGHT HOURS	FIXED COST ^a	DIRECT OPERATING COST ^b	TOTAL COST	AVERAGE COST ^d PER FLIGHT HOUR
360	\$161,170	\$26,017	\$187,187	\$519
600	161,170	43,362	204,532	340
1200	161,170	86,724	247,256	206
1800	161,170	130,086	291,256	161

(a) figures taken from Table I7

(b) calculated as flight hours times operating cost per hour

(c) column (2) + column (3)

(d) column (4) ÷ column (1)

22

shared between the State and participating hospitals. For example, a hospital might be willing to upgrade its communication equipment and/or undertake construction of a helipad if it expected to receive new inpatient revenue from the persons being transported by helicopter. In light of this, two alternative cost models were developed. In model 1, the State only takes cost responsibility for the helicopter and related expenses. The helipad and communications costs are borne by the recipient hospital. In model 2 we assume the State takes responsibility for all costs of the system. The estimates of total system cost per city for the alternative models are presented in Table XII.

In Table XII the cost estimates are based upon 600 annual flight hours for the helicopter. Since helicopter costs vary from the figures shown in the table depending upon whether the helicopter flies more or less than 600 hours per year. The annual cost per site for model 1 amounts to \$319,441 at the 600 hour annual utilization rate, while they amount to \$346,891 for the same rate in model 2. The additional systems cost in model 1 consists of flight operations for the whole system, interest charges on the initial capital investment, and miscellaneous and overhead costs. In model 2 the costs of the helipad construction and communications equipment are also included. It is likely that the cost of the helipad and communications equipment will vary from site to site. The figures shown in the table for these costs, therefore, may not accurately reflect what the actual cost will be for each site. The figures shown are the actual costs incurred by one hospital when it recently adopted a private helicopter ambulance service.³

³The actual communications cost will also depend upon whether the EMS of Missouri goes forward with the statewide emergency medical communications system.

TABLE XII
ANNUAL ALLOCATED SYSTEM
COST PER SITE

I. State only provides Helicopters

Helicopter ^a	\$204,532
Dispatchers (3) ^b	48,300
Director Flight Operations ^c	4,600
Interest ^d	36,309
Miscellaneous and overhead ^e	25,700
TOTAL COST	\$319,441

II. State Provides Helicopter, Helipad and Communication Equip.

Helicopter ^a	\$204,532
Dispatchers (3) ^b	48,300
Director Flight Operations ^c	4,600
Depreciation (Helipad and Communication Equip.) ^f	17,250
Interest ^d	44,709
Miscellaneous and overhead	27,500
TOTAL COST	\$346,891

(a) assumes 600 flight hours

(b) salary of \$14,000 per year + 15% fringe

(c) salary of \$20,000 per year + 15% allocated
equally over 5 site locations

(d) 7% of initial capital outlay of \$518,700

(e) calculated as 10% of total cost less interest

(f) \$35,000 helipad amortized over 4 years, \$85,000 communication equipment
amortized over 10 years

(g) 7% of initial capital outlay of \$638,700

Appendix 3

HELICOPTER SERVICE COSTS, FIRST YEAR OF OPERATION (Based on a Bell LongRanger II helicopter, June 1980)

	RMH LEASE	PURCHASE USED	PURCHASE NEW
Purchase price with options	-	\$400,000	\$435,000
Ambulance configuration	-	30,000	30,000
Total purchase price	-	<u>\$430,000</u>	<u>\$465,000</u>
Down payment, 20%	-	86,000	93,000
Insurance, 9%	-	38,700	41,850
Interest, 15% x 80% financed	-	51,600	55,800
Depreciation, 8 years, 15% residual	-	45,688	49,406
Maintenance, reserve for overhaul, parts	-	75,000	75,000
Fuel	-	32,000	32,000
Spare parts inventory	-	20,000	20,000
Reserve for contingencies	-	15,000	15,000
Subtotal	-	<u>\$363,988</u>	<u>\$382,056</u>
Two pilots @ \$22,800 each	-	\$ 45,600	\$ 45,600
Pilot relief & backup	-	5,600	5,600
One mechanic	-	18,000	18,000
Mechanic relief & backup	-	2,700	2,700
Benefits & tax package	-	15,900	15,900
Recurrent training	-	3,000	3,000
Subtotal	-	<u>\$ 90,800</u>	<u>\$ 90,800</u>
Helipad & communications consulting	-	\$ 4,000	\$ 4,000
Marketing & implementation consulting	-	6,000	6,000
Certificate of Need consulting	-	5,000	5,000
Overhead (accounting, management, etc)	-	15,000	15,000
Subtotal	-	<u>\$ 30,000</u>	<u>\$ 30,000</u>
TOTAL	\$465,972	\$484,788	\$502,856
PER MONTH	\$ 38,831	\$ 40,399	\$ 41,905

Note: The above costs do not include the costs of the helipad, communications, flight nurses, medical equipment, dispatchers, marketing materials, and other indirect program costs. Second year costs for purchase of the helicopter would be lower, due largely to the absence of a down payment. Included in the RMH lease is the availability of a fully dedicated and configured backup helicopter, which is not available for a purchased helicopter. The above analysis is based on flying 600 hours per year.

Rocky Mountain Helicopters, Inc.

Appendix 6

RECOMMENDED STANDARDS FOR HOSPITAL-BASED AIR MEDICAL SERVICES

I. PREAMBLE

To complement the nation's evolving emergency medical services system, hospital-based emergency air medical services should be established for the transport and care of seriously ill and injured patients for whom conventional ground ambulance transportation is not appropriate. Hospital-based emergency helicopter services may assist in providing high quality emergency medical care rendered by specially trained medical personnel, in an environment which serves as an extension of the hospital's emergency service. The following recommended standards have been developed to assist hospitals, physicians, and health planning organizations evaluate the feasibility of establishing hospital-based emergency air medical service programs in a region. These standards also serve as minimum requirements for membership in the American Society of Hospital-Based Emergency Air Medical Services (ASHBEAMS). These standards apply to hospital-based emergency air medical services, and do not address the important systems which have been developed in some states using military or public service aircraft.

II. EQUIPMENT

Hospital-based emergency air medical services should utilize aircraft which facilitate provision of high quality intensive care to seriously ill or injured patients.

- A. The aircraft utilized by a hospital-based emergency air medical service should at a minimum:
 - a. be able to carry at least one patient and one medical attendant, with space for an additional attendant if indicated by the patient's medical condition;
 - b. carry the patients inside the cabin of the aircraft, and allow access to the patient by medical attendants;
 - c. have radio communications with hospitals and public safety vehicles;
 - d. the helicopter should be equipped with at least the following:
 - 1) medical oxygen
 - 2) suction
 - 3) airway management equipment, including endotracheal intubation equipment
 - 4) cardiac monitor/defibrillator
 - 5) splinting and bandaging equipment
 - 6) all medications necessary for emergency cardiac, traumatic, and other patient conditions, as approved by the service medical director.
 - 7) medical anti-shock trousers
 - e. be equipped with survival gear appropriate to the environment (for example, winter survival gear for cold environments, or life raft for over-water operations);
 - f. Have adequate interior lighting for patient care arranged in such a manner so as not to interfere with the pilots vision;
 - g. meet all necessary FAA safety requirements;
- B. The ASHBEAMS Committee on Standards and Clinical Practice will develop similar standards for intensive care fixed wing aircraft.

III. STAFFING

A.. Medical Director

The hospital-based emergency air medical service must have a physician medical director who by training and experience is qualified in emergency and intensive care. The medical director should be responsible for supervising the quality of patient care provided by the flight crew. The medical director should be assisted by an administrative coordinator.

B. Flight Crew

Hospital-based emergency air medical services should be established for the rapid transport of seriously ill or injured patients who require a high level of intensive care while en route. As such the skill and training of the medical flight crew must be commensurate to this level of care. At a minimum, the medical flight crew should consist of at least one registered nurse with specialized training in intensive and emergency care, including the following areas:

- a. Certification in Advanced Cardiac Life Support according to the standards of the American Heart Association, including EKG interpretation, defibrillation, endotracheal intubation, and administration of cardiac medications, as well as training in the assessment and care of other medical emergencies.
- b. Assessment and emergency care of shock and trauma, including multiple trauma, head injuries, burns, and other injuries.
- c. Pediatric emergencies.
- d. Obstetrical and neonatal emergencies.
- e. Behavioral and psychiatric emergencies.
- f. Altitude physiology.
- g. EMS communications.
- h. Aircraft and flight safety.
- i. Individual hospitals may wish to require that flight crew members pass a flight physical.
- j. Flight crew should be knowledgeable of all patient care equipment on board.
- k. Flight crew should receive orientation on the use of extraction equipment.

In addition to these specially-trained flight nurses, physicians or other specialized health care personnel may be utilized.

These personnel should be assigned to the helicopter service as their first priority, although they may be assigned to other patient care units for continuing education purposes. (The Committee on Standards and Clinical Practice will also consider minimum qualifications for pilots, and whether all flight personnel should meet the requirements of Part 135 of the Federal Aviation Regulations).

IV. HOSPITAL CAPABILITIES

Since hospital-based emergency air medical service programs require a significant dedication of resources, hospitals must carefully evaluate their own capabilities and those of other institutions in the region

prior to initiating a program. In evaluating the feasibility of establishing a service, hospitals should consider whether they:

- a. Have 24-hour physician staffing the hospital's emergency treatment center.
- b. Meet the 1979 edition of the standards of the American College of Surgeons as either a Level I or Level II trauma center. (Note: the 1979 edition does not specify minimum service volume requirements). Hospitals should also evaluate their categorized capabilities for care of cardiac, medical, burn, neonatal and pediatric and other emergencies.
- c. Have a dedicated communications center with 24-hour dispatcher staffing and all appropriate radio and telephone communications equipment.
- d. Have or can build a helipad near the hospital emergency service. The helipad may be ground or roof level, but should not be so far away as to require ground transportation from the helipad to the hospital. The helipad must be situated in a manner that assures safe access. The FAA have published guidelines on helipad design.
- e. Have the financial resources necessary to initiate and continue operations of this program.

V. ACCESSIBILITY

Hospital-based emergency helicopter service programs should provide service which is available and accesible to the population of their service area. They should:

- a. Be available 24 hours per day to authorized callers within the service area, except to the extent that weather, the aircraft being on another flight, maintenance, or other reasons prevent response.
- b. Accept medically necessary calls from any physician or other hospital emergency personnel, or from any ambulance, rescue, law enforcemnt, or other appropriate agency without questioning the ability of the patient to pay for services rendered.

VI. DEMONGRAPHIC AND GEOGRAPHIC BASE

Hospital-based emergency air medical services should have a minimum service volume and service an area which is adequate to maintain quality and cost-effectiveness.

VII. QUALITY ASSURANCE

Hospital-based emergency helicopter services must have a physician director who is responsible for reviewing the quality of emergency medical care provided through the air medical service. Programs must maintain adequate patient records of care provided at the site, and en route to the receiving hospital. To the degree possible, there should be follow-up on emergency department, in patient care and patient outcome. The physician direct should periodically audit all emergency patient care, utilizing the same standards as used for the hospital's emergency treatment center. The physician director should develop and

enforce continuing education requirements for all medical personnel assigned to the air medical service. In order to achieve membership in ASHBEAMS, hospital programs must substantially comply with these standards, or show evidence that every effort is being made to comply.

Approved as draft for submission to the Standards and Clinical Practice Committee of the American Society of Hospital-Based Emergency Air Medical Services (ASHBEAMS) at the First Annual ASHBEAMS meeting at Hermann Hospital, Houston, Texas on December 12, 1980.

HOSPITAL HELICOPTER AMBULANCE SERVICES

ALABAMA

Carraway Methodist Medical Center
Birmingham

ARIZONA

Good Samaritan Hospital
Phoenix

John C. Lincoln Hospital
Phoenix

Phoenix Baptist Hospital and Medical Center
Phoenix

CALIFORNIA

Loma Linda University Medical Center
Loma Linda

Memorial Hospital Association
Modesto

Memorial Hospital Medical Center of Long Beach
Long Beach

St. Agnes Hospital and Medical Center
Fresno

University Hospital
San Diego

COLORADO

St. Anthony's Hospital System
Denver

FLORIDA

Baptist Hospital
Pensacola

Baptist Medical Center
Jacksonville

INDIANA

Indiana University Hospital
Indianapolis

Methodist Hospital of Indiana
Indianapolis

IOWA

Iowa Methodist Medical Center
Des Moines

University of Iowa Hospital and Clinics
Oakdale

LOUISIANA

West Jefferson General Hospital
Marrero

MISSOURI

Missouri Baptist Hospital
St. Louis

St. Joseph Hospital of Kansas City
Kansas City

MONTANA

Billings Deaconess Hospital
Billings

Kalispell Regional Hospital
Kalispell

St. Vincent Hospital
Billings

NEBRASKA

St. Joseph Hospital
Omaha

NEVADA

Valley Hospital
Las Vegas

NEW YORK

Westchester County Medical Center
Valhalla

OHIO

St. Vincent Hospital and Medical Center
Toledo

OKLAHOMA

Oklahoma Children's Memorial Hospital
Oklahoma City

St. Francis Hospital
Tulsa

OREGON

Emanuel Hospital
Portland

PENNSYLVANIA

Allegheny General Hospital
Pittsburgh

Geisinger Medical Center
Danville

TEXAS

Harris Methodist Hospital
Fort Worth

Hermann Hospital
Houston

Methodist Hospital of Dallas
Dallas

UTAH

Holy Cross Hospital
Salt Lake City

LDS Hospital
Salt Lake City

University of Utah Hospital
Salt Lake City

Appendix 8

HELICOPTER SPECIFICATIONS (Typical aeromedical evacuation models)

Aerospatiale SA 319B Alouette III

Country of Origin: France

Power Plant: One 789 shp Turbomeca Astazou XIVH turboshaft

Performance: Max speed, 137 mph at sea level; max. cruise, 122 mph; hovering ceiling (in ground effect) 10,170 ft; range (6 passengers), 375 miles.

Dimensions: Rotor diameter 36'1.75"; fuselage length 32'10.75"

Aerospatiale AS 350D AStar

Country of Origin: France

Power Plant: One 740 shp Turbomeca Arriel or 592 shp Avco Lycoming LTS 101 turboshaft

Performance: Arriel turboshaft) Max speed, 166 mph; max. continuous cruise at sea level, 143 mph; hovering ceiling (in ground effect), 10,660 ft; range 430 miles

Dimensions: Rotor diameter 35'.75"; fuselage length 35'9.5"

Bell Model 206B Jetranger III

Country of Origin: United States

Power Plant: One 420 shp Allison 250-C20B turboshaft

Performance: Max speed, 140 mph at sea level; max cruise 133 mph at sea level; hovering ceiling (in ground effect), 12,700 ft.; range (no reserves) 360 miles

Dimensions: Rotor diameter, 33'4"; fuselage length, 31'2"

Bell Model 206L Longranger

Country of Origin: United States

Power Plant: One 420 shp Allison 250-C20B turboshaft

Performance: Max speed, 144 mph at sea level; max cruise 136 mph at sea level; hovering ceiling (in ground effect), 8,200 ft; range, 390 miles at sea level

Bell Model 212 Twin Two-Twelve (UH-1N)

Country of Origin: United States

Power Plant: One 1,800 shp Pratt & Whitney PT6T-3 coupled turboshaft

Performance: Max speed, 121 mph at sea level; hovering ceiling (in ground effect), 17,100 ft, max range, 296 miles

Dimensions: Rotor diameter, 48'2.5"; fuselage length 42'10.75"

Hughes 500D

Country of Origin: United States

Power Plant: One 420 shp Allison 250-C20B turboshaft

Performance: Max speed, 175 mph at sea level; cruise 160 mph at 4,000 ft; hovering ceiling (in ground effect) 8,800 ft; max range, 263 miles

Dimensions: Rotor Diameter, 26'5: fuselage length, 21'5"

Messerschmitt-Bolkow-Blohm BO 105
Country of Origin: West Germany
Power Plant: Two 420 shp Allison 250-C20B turboshafts
Performance: Max cruise, 152 mph at sea level; hovering ceiling
(in ground effect) 9,514 ft; range, 388 miles
Dimensions: Rotor diameter, 32'1.75"; fuselage length, 28'5"

SOURCE: Green, William, The Observer's Book of Aircraft, 1979 ed.,
London, Frederick Warne & Co. Ltd.



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF MILITARY AFFAIRS
OFFICE OF THE ADJUTANT GENERAL
FRANKFORT 40601



7 January 1981

Mr. Norman W. Lawson, Jr.
Assistant Reviser of Statutes
Legislative Research Commission
State Capitol
Frankfort, Kentucky 40601

Dear Mr. Lawson:

In reference to your letter of 11 December concerning the feasibility of establishing a helicopter ambulance service, I am pleased to respond.

After much consideration and discussion with members of my staff, we have determined it would not be legal for the National Guard to participate in this type of a program. The Army regulations prohibit us from providing any service on a continuous basis that would be competitive with civilian enterprise.

I am pleased to share with you some of our findings: it would take a minimum of one aircraft; two maintenance technicians; eight aviators; and four trained medical personnel technicians. This would also require a communications system capable of communicating with local areas, state police, and the various hospitals.

The cost would be tremendous but what really concerns me most is the liability. Under no condition would I want to transport a patient without a physician or a registered nurse on board.

Originally, we started providing medical transportation for neonatal patients in Eastern Kentucky to the University of Kentucky Medical Center. Very quickly the cost exceeded our capability. Therefore, it was necessary for us to enter into an agreement with the University of Kentucky and the Department for Human Resources to financially support this program in a State Active Duty status. We are averaging over 100 emergency flights a year. I have had many inquiries from the medical profession, such as to transport cardiac patients. I find it is virtually impossible for us to expand the present service we are providing.

It has been, and will continue to be, our desire to respond any time we can save a life but only within our capability and Army regulations.

Mr. Norman W. Lawson


- 2 -

7 January 1981

I understand there are some local people in Lexington who are considering establishing such service.

Please be assured of our interest and if we can be of any assistance, please do not hesitate to call on us. I thank you for your invitation to respond but I believe this program is a little more than we can handle.

Sincerely,



BILLY G. WELLMAN
Major General, KyNG
The Adjutant General

Appendix 10



COMMONWEALTH OF KENTUCKY
KENTUCKY STATE POLICE
FRANKFORT 40601

OFFICE OF THE COMMISSIONER

January 5, 1981

Mr. Norman W. Lawson, Jr.
Assistant Reviser of Statutes
Legislative Research Commission
Frankfort, Kentucky 40601

Dear Mr. Lawson:

I am in receipt of your letter dated December 11, 1980, regarding the possible interest of the Kentucky State Police in an air ambulance program. The Kentucky State Police are interested in this program and offer the following information for your consideration.

The area of Kentucky in most need of this service is eastern Kentucky. Presently, the MAST units from Fort Knox and Fort Campbell appear to be fulfilling the need in western Kentucky. Assuming that the MAST units will continue this coverage in western Kentucky, the Kentucky State Police would suggest the placement of two helicopters as close as physically possible to the University of Kentucky Medical Center in Lexington. The primary reason for selecting this location is the immediate availability of trained nurses and doctors that would be required on many air-vac missions. Twenty-four hour coverage utilizing an on-call rather than a standby status for each helicopter would require three pilots. Routine maintenance requirements may require the hiring of an additional mechanic(s) by the Department of Finance.

The projected cost figures for this program would include \$327,000 per helicopter (includes Kentucky State Police radio); \$20,000 average annual salary per pilot; \$312,00 per year operating and maintenance costs for each helicopter (based on thirty hours of flying per week times \$200 per hour); and approximately \$6,000 to \$8,000 per pilot for training.

Norman W. Lawson, Jr.
Page Two
January 5, 1981

In order for the Commonwealth of Kentucky to receive maximum utilization of the helicopters in this program, the Kentucky State Police recommend that the helicopters be used for criminal justice/law enforcement missions when not flying air-vac. Types of law enforcement activities could include manhunts, bank robberies, burglaries, and kidnapping. In these situations, an aircraft with hovering and landing capabilities is far superior to a fixed winged aircraft.

If you have any further questions regarding this issue, please do not hesitate to call on us.

Sincerely,

A handwritten signature in cursive script, appearing to read "A.D. Fortner", is written over a horizontal line.

A.D. Fortner, Lt. Colonel
Acting Commissioner

ADF:pr

cc: Secretary Neil J. Welch

Appendix 11
UNIVERSITY OF KENTUCKY
LEXINGTON, KENTUCKY 40536

ALBERT B. CHANDLER
MEDICAL CENTER
OFFICE OF THE VICE PRESIDENT

TELEPHONE
505-1200-1111

December 1, 1980

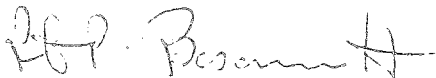
Norman Lawson, Attorney
Legislative Research Commission
State Capitol Building
Frankfort, Kentucky 40601

Dear Mr. Lawson:

This is a letter in support of the concept of an emergency medical helicopter system for the state of Kentucky. As we understand the proposed project, one helicopter system would be established in Western Kentucky and one in Eastern Kentucky which would provide emergency air evacuation to major trauma centers in the Commonwealth. We further understand that this project would initially be funded by the state of Kentucky with the participating institutions assuming the major responsibility for the continuation of this project after an initial establishment period.

We feel that the University of Kentucky Medical Center would be an appropriate home base for an emergency medical helicopter service serving Eastern Kentucky. We are, however, committed to the establishment of only those new projects which will have a sound financial outlook. With this in mind, we can support the concept of the establishment of such a helicopter service, but will need to work with you to determine the feasibility and long range financial implications of this project.


Sincerely,



Peter P. Bosomworth, M.D.
Vice President for the Medical Center



D. K. Clawson, M.D., Dean
College of Medicine



David C. Schmauss, Executive Director
University Hospital

PPB:DKC:DCS:bks



University of Louisville
Health Sciences Center

Vice President for Health Affairs

Louisville, Ky. 40292

December 17, 1980

Mr. Norman Lawson
Legislative Research Commission
Capitol Building
Frankfort, Kentucky 40601

Dear Mr. Lawson:

In reply to your inquiry about the desire of the University Hospital to operate an emergency medical helicopter service, I am pleased to assure you that such an undertaking is consonant with the mission of the Hospital and is supported by both the administration and the Board of Governors of University Hospital. A proposal was presented to the Board of Governors of the Hospital on Tuesday, November 25, 1980, and the Board voted unanimously to support the following resolution:

"The Board of Governors of University Hospital endorses the concept of the establishment of a helicopter ambulance service at University Hospital, and recommends that Health Sciences Center administration be authorized to negotiate funding of such a program with the Legislative Research Commission."

The development of an emergency medical helicopter service has long been a goal of the Hospital and represents an integral part of our long range plan. It is our belief that such a program is both needed and viable and represents an essential element in a comprehensive emergency medical service program for our area.

Sincerely,

Harold E. Boyer, D.D.S., M.Sc.
Vice President for Health Affairs

mjn
2446L

cc: Mr. Nolen Allen
Dr. Mary Ann Cooper
Dr. William Ekstrom
Dr. Donald Thomas

